Manitoba Bulletins

Mineral Prospects in Southeastern Manitoba

RICE LAKE, MASKWA RIVER AND BOUNDARY DISTRICTS

BY

J. S. DeLURY

PUBLISHED BY AUTHORITY OF GOVERNMENT OF MANITOBA

OFFICE OF COMMISSIONER OF NORTHERN MANITOBA
The Pas, Manitoba

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The Pas, Manitoba

University of Manitoba,
Department of Geology.

December 1st, 1920.

Dr. R. C. Wallace,
Commissioner of Northern Manitoba,
The Pas, Man.

Sir:

A bulletin on "Mineral Prospects of Southeastern Manitoba" is forwarded herewith.

In accordance with your instructions, the Rice Lake and Maskwa River Districts were examined during the summer of 1920. In this work I was fortunate in having associated with me Messrs. L. G. Thompson and R. W. Hiebert, of the Department of Geology, University of Manitoba.

During the past two or three years I have been in close touch with developments in an area which I shall call the "Boundary District," embracing the country adjacent to West Hawk, Star and Falcon Lakes, near the Ontario boundary. This makes it possible to add a chapter descriptive of this district and its deposits.

Trusting that the contents of the bulletin will meet the wishes of all who have an interest in the development of Manitoba's mineral deposits, I am,

Yours respectfully,

J. S. De LURY.

CONTENTS

INTRODUCTION

Purpose and Scope of the Bulletin

This bulletin is written with the object in view of supplying as much information, as is possible in condensed form, concerning the metallic mineral prospects of the southern portion of the Province of Manitoba. It will supplement a bulletin written by Dr. R. C. Wallace in 1919, on "Mining and Mineral Prospects in Northern Manitoba" in such a way that the two publications together will serve as a guide to information concerning the metalliferous areas of the whole of the province.

Most of the mineral-bearing areas of the southern portion of Manitoba have received brief visits from members of the Geological Survey of Canada and from other investigators, but reports* and records of these visits are widely scattered, many of them are brief and confined to limited aspects and some are out of date. In the writing of this bulletin, all available publications have been consulted and a bibliography will be appended which will be found of assistance in supplying the reader with sources of information concerning many details which are not possible in a bulletin of this scope.

All of the districts which are to be described have been visited by the writer and an effort was made to see the most promising deposits in each. Following a general description of Southern Manitoba as a whole, each mineral-bearing area will be treated separately. It should be needless to point out that it would be an impossibility to visit all locations or to attempt to sample the mineral deposits. The information to be supplied must therefore be largely of a general nature and details will be given only where they are of special interest.

Historical

The portion of Manitoba which first received considerable attention from prospectors was naturally, on account of its position and accessibility, the area lying close to the Canadian Pacific Railway and immediately west of the Ontario boundary. Several claims were staked in this locality during the boom which accompanied mining exploitations in the area of the Lake of the Woods in the nineties. During the same years some interest was taken in the gold-mining possibilities of the eastern shore and adjacent islands of the southern part of Lake Winnipeg. For several years following these earlier developments there was comparatively little interest taken in metalliferous deposits, except for a small amount of prospecting and fitful attempts at mining near Lake of the Woods and on the eastern shore of Lake Winnipeg. During this time, however, some attention was paid to non-metallic deposits.

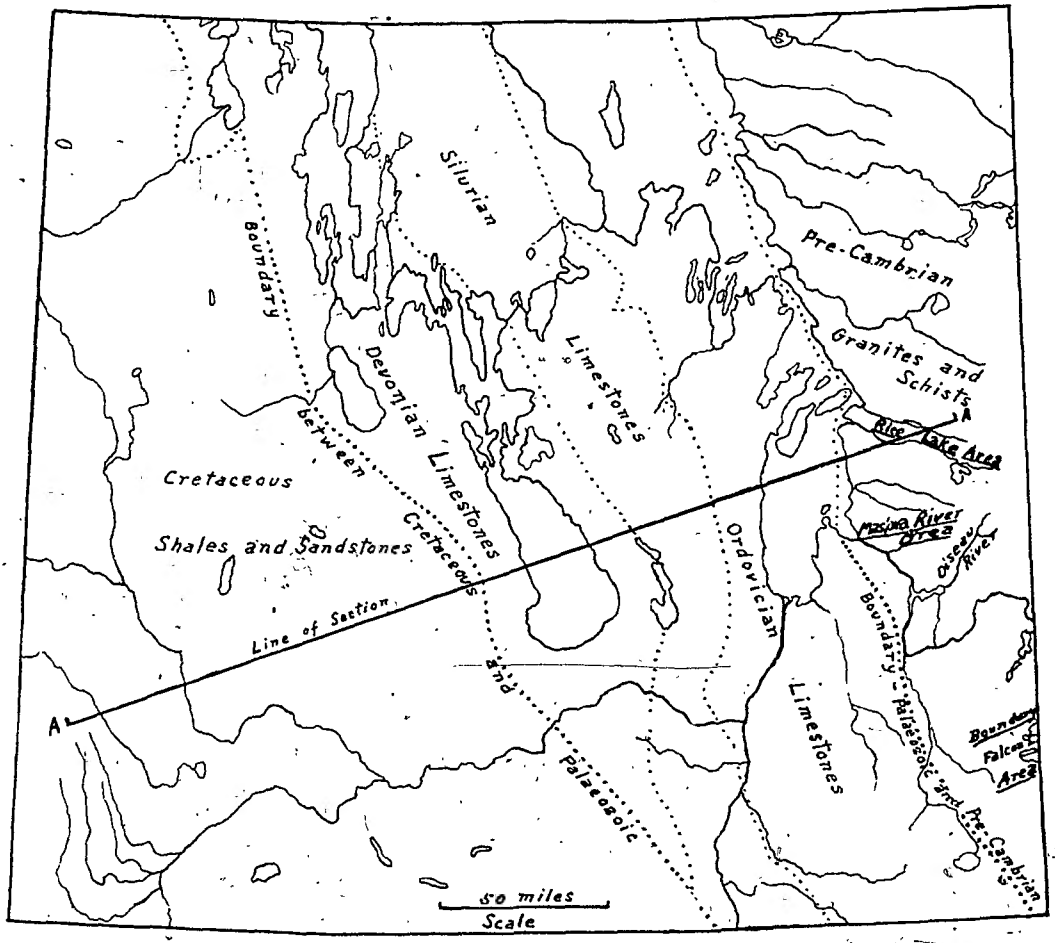
Gypsum was first reported as occurring in the province by J. B. Tyrrell, in 1889. Production of gypsum products was started at Gypsumville twelve years later and has been increasing fairly steadily up to the present time. Salt was recovered from brine springs occurring to the west of Lake Winnipegosis from early in the 19th century until the advent of the Canadian Pacific Railway into Manitoba. A brick-making industry has become well established in the province. In 1910 about 26 brickyards were in operation. Portland cement has been manufactured in Winnipeg for several years. Limestone quarries have been opened at several points and they supply excellent building stone and other structural materials.

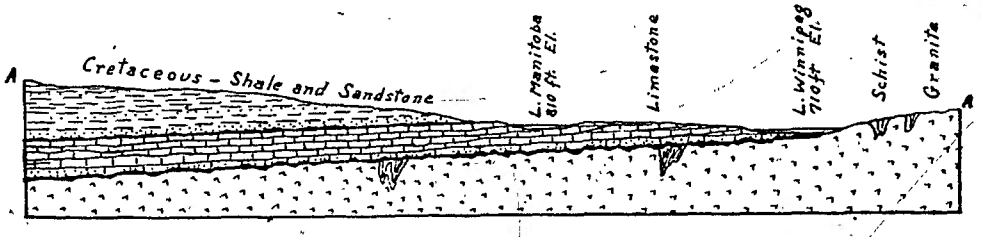
There was a revival of interest in the occurrence of metalliferous deposits in the province with the discovery of gold on the shore of Rice lake in 1911. Fresh discoveries of gold-bearing quartz have been made every year in that district since the time of the first discovery. During the past two or three years the latent possibilities of Southern Manitoba have been made evident by the finding of some of the rarer metalliferous minerals in the country tributary to Lake of the Woods, by the locating of deposits carrying nickel and copper in the Bear (Maskwa) River area and from the results of further prospecting in the Rice Lake district.

* Reports and Papers referred to in the bulletin are listed in Chap. V.

SOUTHERN MANITOBA

Outcrops of Prominent Geological Formations. Index of Metalliferous Areas.





STRUCTURAL SECTION

Other mineral occurrences have claimed some attention. Lignite occurs in Turtle Mountain in Southwestern Manitoba and has been mined in a small way for several years. Oil-shales are found in the western part of the province but they have not been thoroughly investigated.

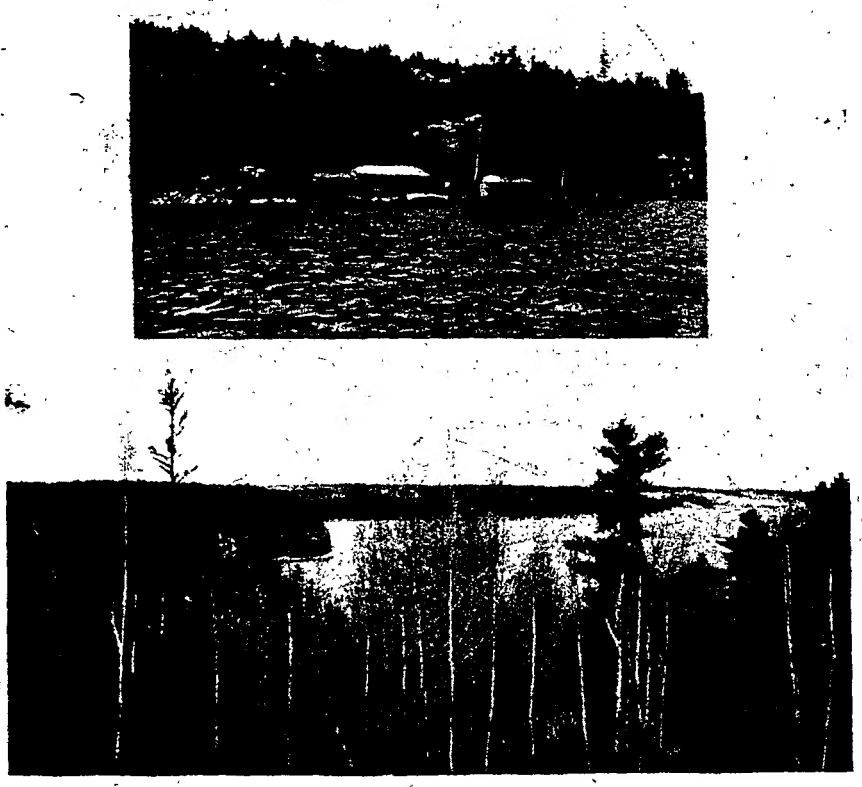
Surface Features

Southern Manitoba is regarded as that part of the province which lies to the south of Township 45. It is the original Province of Manitoba, as it was prior to the year 1912, when the provincial area was increased by the vaster stretch of country known as Northern Manitoba. This older portion of the province is almost square in outline and has an area of approximately 72,000 square miles.

Several large lakes, including Winnipeg, Manitoba and Winnipegosis, cover about one-eighth of the country. The waters of the area all find their way into Lake Winnipeg, which acts as a huge settling basin and which is drained by means of Nelson River into Hudson's Bay. Lake Winnipeg has an elevation of 710 feet above sea level. The country rises gradually from the east side of the lake to heights of over 1200 feet near the Ontario boundary. To the west there is a very gentle ascent until the escarpment and western hills are reached; here there is a rapid rise to elevations of about 2500 feet.

The greater part of the area of Southern Manitoba is wooded, though there is a large stretch of prairie country in the basins of Red and Assiniboine Rivers.

The surface features of the province have been determined by its geological history, which will be discussed in the next chapter when further light will be thrown on topographical features.



Views in Boundary District. 1—*Martin Cabin, north shore, West Hawk Lake.*
2—*View of same Lake in Winter.*

CHAPTER I.

GEOLOGICAL FEATURES OF SOUTHERN MANITOBA

As the bulletin is written primarily to describe mineral deposits, only a brief outline of the geological history and features of Southern Manitoba will be attempted. This outline will serve as a necessary basis for subsequent discussions of mineral deposits. Reference to the accompanying map and section will aid in a comprehension of the general relations existing between the prominent geological formations. A glance at these will show that the area of Southern Manitoba is occupied by three prominent and distinct groups of rocks. The oldest of these three groups is seen on the map outcropping in the eastern part of the country, and in the section underlying the younger rocks to the west. The name given to these oldest formations is pre-Cambrian: they are so named to distinguish them from the Cambrian and later rocks which usually show the presence of fossils. Granites and similar rocks make up the bulk of the pre-Cambrian in Manitoba, though in several relatively small areas many other types are found. Farther west in a wide belt which outcrops in many places in the vicinity of the large lakes, are the limestones which constitute the second main group of Manitoban rocks. These underlie the third group, which consists largely of shales and sandstones and which outcrops in the escarpment of Western Manitoba and occupies the great prairie plains. The geological history of the southern portion of the province will be brought out in the following discussion of these three prominent formations.

Pre-Cambrian

It was pointed out that these rocks are the oldest, that they outcrop on the eastern side of the province and that they underlie the younger formations to the west. Their outcrop extends into Ontario and widens to the north, embracing the whole of the more northerly parts of Manitoba. The western boundary of the outcrop, so far as it concerns Southern Manitoba, is roughly a line drawn through the major axis of Lake Winnipeg. This great mass of rock is made up largely of granite and granite-like rocks, which, from their nature, we know to have been formed from the molten state at depths of thousands of feet below the surface which existed at the time of their formation. Included with the granite in the same mass and area are smaller bodies of rocks comprising many different varieties: some of these were laid down under atmospheric conditions and indicate the presence of an atmosphere and surface waters at the time of their formation; others were formed from the molten state like granite; but, unlike granite many of then are fine-grained and were formed by the pouring out of lavas on the earth's surface or on the sea bottom. These lavas and water-formed rocks no doubt covered the whole of the surface now occupied by granite. Their structures show that they have been folded and squeezed, from which it is inferred that they were formed into ranges of mountains. While the folding was in progress granites intruded the other rocks in the depths. These rocks are among the oldest known in the history of the earth, and during the millions of years which have elapsed since their formation the old mountain ranges have been worn down to their roots, which are seen in the several patches of lavas and other rocks contained in the granites.

This large area of pre-Cambrian rocks is but a comparatively small part of an enormous area which lies around Hudson's Bay west to the MacKenzie river and east to the Atlantic ocean and occupies the northern parts of Manitoba, Ontario and Quebec. They are throughout the rocks which are the source of practically all of the metalliferous ore produced in these provinces.

The end of pre-Cambrian time marks the close of mountain-forming movements and of volcanic activity so far as Manitoban areas are concerned. Rocks formed since that time indicate no other prominent earth-movements than slow changes in the elevation of the land. Following the folding of mountains during early times, there was a long period of erosion during which the mountains were worn down and granite areas were exposed. This wearing process has continued to the present time with the exception of considerable periods when large areas were covered by the sea.

Limestones (Paleozoic)

Next in age to the pre-Cambrian formations and lying to the west of them are some thick limestone beds which outcrop more or less in a wide belt of country which strikes northeasterly and includes most of the area in the vicinity of the large lakes. These beds of limestone were laid down after the older rocks had suffered a great deal of erosion, when the ocean, coming in slowly from the west, gradually submerged and occupied probably all of the area of Southern Manitoba. In this sea were laid down a few beds of sand and mud, but more abundantly the shells of animals and some remains of plants, which have been cemented and compacted into thick beds of limestone. At the base of the limestones is a bed of very pure quartz-sand known as the Winnipeg Sandstone. It is an old beach sand formed when the sea invaded pre-Cambrian areas of rock. Records of wells which were drilled in the limestone areas show that the floor on which the limestones were laid consists of the same rocks that are found in the outcrops of older formations which are found to the east. The limestones and included rocks have a thickness of from a few hundred to well over a thousand feet in places, indicating that vast time, probably millions of years, was required for their building. They are the source of many of the non-metallic mineral products of the province.

Shales and Sandstones (Cretaceous)

After the deposition of the limestones there seems to have been a withdrawal of the sea from the Manitoban area and there followed a long interval of quiet, which in a sense

Showing effects of glaciation in Rice Lake District.

is a lost interval so far as the geological history of Manitoba is concerned, in that there are no rocks to furnish us with a record of the time.

Later on, however, the country was invaded by a shallow sea in which were laid down thick beds of sand and mud. These beds have been compressed and cemented into shales and soft sandstones which are seen outcropping in the escarpments of the western part of the province. These formations probably covered most of the area of Southern Manitoba at one time, but, together with the limestones, they have been worn away from large areas in eastern and central portions of the province.

Glaciation (Pleistocene)

After the formation of shales and sandstones, the most important geological activity to be chronicled is the invasion of the area of Manitoba by an ice-sheet during the Great Ice Age, when the greater part of Canada was covered by glaciers just as Greenland is at the present time. During this invasion large areas which are now occupied by pre-Cambrian rocks were uncovered of their overlying mantle of sediments and were further worn down. Hundreds of feet of limestone, shale and sandstone were removed from Manitoban areas,

particularly in the central belt; and on the retreat of the ice-sheet the edges of these formations were left exposed in wide bands, which are seen on the map to be running in a northwesterly direction. A huge basin was left, the bottom of which is now occupied by Lake Winnipeg. This basin, stretching from the western hills across Manitoba, was filled by waters from the melting ice and by the drainage from ice-free areas to the west and south. The immense lake, so formed and called Glacial Lake Agassiz, was drained through Minnesota into the Mississippi river and was prevented from reaching Hudson's Bay by the front of the ice-sheet which was slowly retreating northwards. Finally the ice retreated so far that a new system of drainage was established to the north and the old glacial lake was drained. Besides being responsible for the thick beds of silt found in the basin of the old lake, the ice has left many other evidences of its invasion in Manitoba. Mantles of glacial drift are found in most parts of the province. The ice-sheet is also responsible for the final shaping of the surface of the area of the province: its grooved, striated and rounded hills of rock, its numerous lake basins and its general peneplainal surface.

Economic Features

The pre-Cambrian formations of the eastern portion of southern Manitoba are the most hopeful as metalliferous rocks. The most important ore-deposits of the central portions of Canada and the United States occur in rocks of this age, including as they do the nickel-copper deposits of Sudbury, the cobalt-silver ores of Cobalt, the gold-bearing quartz veins of the Porcupine country, the native copper of Michigan and Canadian Arctic areas and the enormous resources in iron-ore which are found in Minnesota, Wisconsin, Michigan and Ontario. Much hope can not be entertained for the finding of workable bodies of metallic ores in the younger limestones and still younger sandstones and shales of the province, though it should be mentioned that similar limestones to those found here have yielded large quantities of zinc and lead in Missouri and its adjacent states, and that traces of zinc have been found in the limestones of Manitoba. Some building stone is being supplied by the pre-Cambrian formations and no doubt its granites will be abundantly used in future years.

The limestones of Southern Manitoba are an abundant source of structural materials. With them are associated the large deposits of gypsum which occur near Gypsumville, and the salt springs of a belt farther west. Quarries have been opened at many points in the limestone area, notably at Tyndall, Stonewall, Stony Mountain and at several points on the lakes. Some of the rocks from these quarries are excellent building stones; others yield good lime on burning and supply materials for the manufacture of cement and for use in concrete construction.

Lignitic coal is found associated with the shales and sandstones in the western part of the province, at Turtle Mountain. These rocks also supply materials for the manufacture of brick. Petroliferous shales also occur in these younger formations; they may be found to be a valuable resource in the years to come, as a source of oil and fertilizer.

A question is commonly raised as to the possibility of the existence of workable deposits of placer gold in the province. Several finds of nuggets of gold have been recorded and some sands and gravels have yielded colors of the metal. The widespread occurrence of gold-bearing quartz in several parts of the country lends color to the possibility, owing to the fact that in other parts of the world placers occur where gold is found in place. However, the chances of finding large or workable deposits of placer gold in Manitoba are few. Such bodies are found only where there has been a long continued and uninterrupted river or beach erosion of gold-bearing rocks. In Manitoba the erosion products on the surface are largely the direct or indirect results of glacial action, and as there is little possibility in the deposition from glaciers for the sorting that is necessary in the formation of placers, there is little likelihood for the existence of anything but poor or small concentrations. Any valuable placers that may have been formed during the earlier periods of erosion have been removed from the surface and scattered by the ice-sheets wherever their loads were dropped. The ice left fresh rock surfaces at the time of its withdrawal, and the amount of weathering in the rocks since that time is inconsiderable. Apparently the only

possibility for the existence of placer gold, or any other products which require mature weathering and erosion for their formation, would appear to be on the covered upper portions of old buried formations, such as the pre-Cambrian surface underneath the limestone.

Another question that is frequently asked is in regard to the advisability of prospecting the contact between the limestone and pre-Cambrian granite for metalliferous deposits. This is a sedimentary contact as the limestones are younger than the granite and were laid down on them, under water. It is not a promising place for the occurrence of ores since the granite did not fuse its way into the limestone.

There is another economic feature in connection with the erosion of the rocks by recent glaciation which should be dealt with here, as it applies to all of the metalliferous areas. As a result of this type of erosion and the comparatively short time that has elapsed since it took place there has been very little weathering of the rocks and mineral deposits; consequently the latter show their original unaltered materials at or near the surface. As a result of this, it is unnecessary to sink deep shafts, as is often required in unglaciated areas, in order to find the nature of the primary ore, and consequently the prospecting and sampling of an ore-body are made comparatively simple. It is true that owing to certain structures and materials of the mineral deposit and to the location of the outcrops, some ores are changed appreciably near the surface, but this is exceptional, and fairly fresh ore, even in these cases, is usually exposed somewhere on the outcrop. Weathering to a depth of ten feet is unusual and is generally only partial. In very exceptional cases weathering effects are seen at much greater depths but they are in such cases of a minor nature and are localized.

This is only a general review of the economic features of Southern Manitoba as a whole. Many more details will follow in the description of the different mineral-bearing areas.

View towards mouth of Manigotagan River.

CHAPTER II.

RICE LAKE DISTRICT

The name "Rice Lake District" is retained for a wide belt of gold-bearing country extending from Lake Winnipeg to the Ontario boundary, for the reason that custom has established this as the name for the whole district, though it was originally applied to that portion of the country near Rice lake where the first discovery of gold was made and where early developments were commenced. The belt has an area of between 300 and 400 square miles; it strikes in a general northeast-southwest direction with a length of about fifty miles and a width of between five and ten miles. Gold-bearing quartz veins are fairly generally distributed throughout the area.

The gold-bearing area lies in the basins of the Wanipigow or Hole and the Manigotagan or Bad Throat rivers. Here and there throughout the district are exposures of rock, some of them of considerable area, but easily nine-tenths of the surface has not been adapted to simple prospecting through being covered by water, muskeg, soil and heavy growths of vegetation. There is a fairly even slope to the country from the Ontario boundary west to Lake Winnipeg. The highest waters inland have an elevation in the neighborhood of 1000 or 1100 feet above sea level, while the level of Lake Winnipeg is 710 feet. Rapids and falls are numerous on the two principal rivers. The country is practically all forested, though forest fires have destroyed many square miles of the original timber. Here and there are small areas of merchantable timber. Fish, moose, red deer and small game are abundant in the district.

As a rule the higher lands in the eastern portion of the gold-bearing area have more and larger outcrops of rock than the lower lands near Lake Winnipeg. No doubt this fact partially accounts for the relatively fewer discoveries of gold in the western part of the district. Near the lake the country is more generally covered by glacial drift and river deposits cover wider areas than they do farther inland. Some of the soils in the lower river flats seem to be the remains of lake deposits formed in glacial Lake Agassiz. These and other flat covered areas may at some time attract farmers to the country adjacent to Lake Winnipeg.

History of Development

Owing to the fact that several papers dealing with the history of developments in the Rice Lake district have already been published, only a condensed statement will appear in this bulletin. In a report written in 1912, E. S. Moore gives a summary of what was known of the economic possibilities of the area at that time. Extracts from this summary are quoted verbatim:

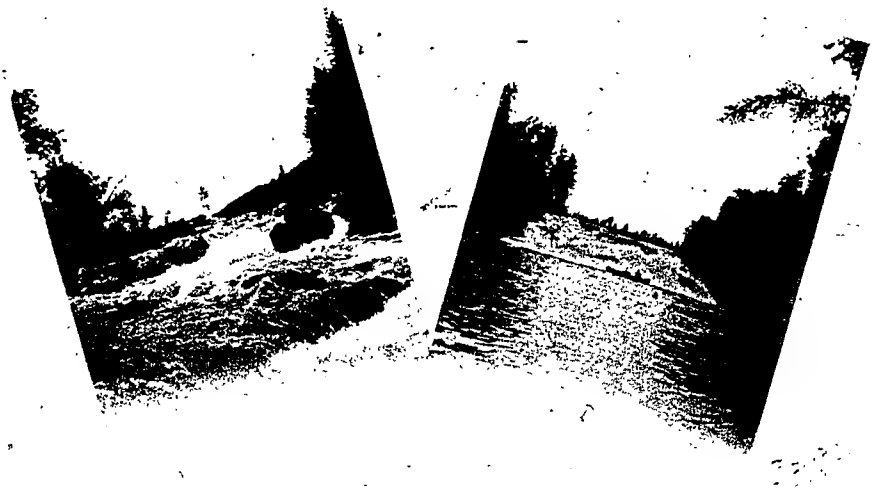
"For a good many years iron has been known to exist on Black island, in Lake Winnipeg, and some gold prospects have been exploited along the shore of the lake in the vicinity of Wanipigow and Manigotagan rivers, but the latter have been practically all abandoned. In March, 1911, Captain A. E. Pelletier discovered the claim on Rice lake, known as the Gabrielle, and the areas which have since attracted attention are those adjacent to Rice lake and Wanipigow river to the north of this lake, one on Long lake and one on the small lake north of Eagle Rock lake."

"The only claim in the region upon which any development work worth mentioning has been done, is the Gabrielle, the first claim discovered."

"The veins described above (meaning the Gabrielle veins and similar ones on Rice lake) are the more important ones found in the region, but there are many others of smaller size or apparently quite barren, scattered throughout this area. There are some around Horseshoe lake, some north of Wanipigow river, and some on Elbow lake, where a large mass crosses the lake at the narrows, near the north end. On Wallace lake, near the northwest corner, there is a mass of white barren quartz about 30 feet in diameter lying near the granite contact."

Moore also mentions the occurrence of iron-formation, of some pyritic schist on Oiseau river, and describes some occurrences of quartz on Long lake.

Since 1912 there has been steady prospecting done by a small number of prospectors, and over two thousand claims have been staked in the area, almost altogether for gold. On several of these claims mining operations were initiated at different times, the more extensive developments of the earlier years being carried on in the vicinity of Rice lake, and in the country near Gold and Hay lakes in later years. A good deal of work has been done on other claims in exposing the surfaces of the veins and in opening them up by means of shallow pits and trenches; this kind of work is characteristic of the later rather than the earlier developments, and it seems to be, by the way, the most economical method of determining whether a prospect has mining possibilities. A large number of claims have been staked for location and, as is to be expected in such cases, they have generally



Falls on Manigotagan (Badthroat) River.

no showings of interest; and the work which has been done on them is of relatively small importance.

The extent of the major operations in the district as a whole is indicated by the fact that of eleven claims each has underground workings of over 100 feet, and together they have a total of over 2300 feet, giving an average of more than 200 feet to the claim. Minor developments represent about an equivalent amount of work.

Geological Features

The rocks found outcropping in the Rice Lake district are all of pre-Cambrian age. As in many other areas in Canada where these old rocks are found, the first geological activity to be recorded is the flowing of lavas. The period during which lava was being poured out was probably a very long one, since there is evidence that the flows built formations that were originally quite thick. These lava-rocks appear in many varieties both as to form and to composition. Some are fine-grained throughout, having a felsitic texture; others have visible to large crystals in a fine-grained mass, that is, they have a porphyritic texture. There is a great series of lavas, some of which are light-colored and acid in composition, others are intermediate, and some are dark-colored and basic.

During a later period, waterlaid deposits of muds, sands and some gravels covered the lavas and were consolidated into hard rocks. The lavas and sediments were affected by mountain-folding and other movements in the earth's crust and huge masses of molten rock were squeezed and melted into them. On cooling, these molten masses solidified

slowly and formed the granites and granite-like rocks which are now found outcropping so abundantly in this and surrounding areas. They are exposed at the surface now, though they were originally formed at great depth, the exposure being the result of the wearing down during past ages of thousands of feet of rock. These granites penetrate, surround and no doubt underlie the older lavas and sediments, which rocks have been markedly altered from their original nature, the change having been brought about by the melting in of the granite and through movements under high pressure. This alteration is apparent in most of the rocks of the district, and generally the most pronounced indication is the schistose or finely laminated structure which is seen in most of the lavas and sediments. This structure accounts for the common naming of such rocks as "schists."

The belts of schist strike roughly northwest-southeast. The laminations in the schist strike generally in the same direction. It is observed for this district, as for all similar areas in Canada, that the structures and nature of the rocks have determined the nature of the surface left after erosion by glaciers, and such topographical features as river-courses, shore-lines, hills and ridges are related to the rock-structures.

In 1912 Moore examined the rocks of the district and in reporting on them gave a provisional classification of the formations. Dresser and Marshall examined smaller areas in 1916 and 1917 and using Moore's classification as a basis for description, gave many additional details concerning the nature and distribution of the different rocks. Extracts from Dresser's report are quoted verbatim:

"In the district examined there are three geological formations besides the surface deposits. These are a series of porphyries, andesites and greenstones, probably extrusive in origin; a group of quartz, biotite and other schists and gneisses, largely, if not wholly sedimentary; and numerous bodies of granite, pegmatite and gneiss intrusive into both of the preceding formations. It is not yet clear which of the first two formations is the older. They were not seen in actual contact and both are older than the granite. Their different origin, however, suggests that there is probably a difference in age. Moore considered the sediments which he named Wanipigow to be younger than the porphyry and andesites (Rice Lake series), mainly from evidence obtained in adjacent parts of the region."

"In tabular form the formations may be provisionally arranged as follows:

QUATERNARY	Pleistocene	Lake deposits. Glacial drift.
	(Unconformity)	
PRE-CAMBRIAN	Manigotagan granite, pegmatite and gneiss.	
	(Intrusive contact)	
	Wanipigow series:	mica schists and gneisses.
	Rice Lake series:	porphyry, andesite and greenstone.

"**Rice Lake Series**—The rocks of this series are chiefly feldspar porphyry, quartz porphyry, andesite and greenstone. All are finely foliated, and over large areas have a singularly uniform dip of 70 degrees towards the south-southwest."

"**Wanipigow Series**—This series in the area described consists chiefly of a quartz-feldspar schist or gneiss containing much biotite and a little sericite. Light-colored garnets are found in it, and near intrusions of pegmatite, tourmaline is common. It ranges in color from light to dark gray. It is a foliated arkose or graywacke."

"**Manigotagan Granite**—This formation occurs in large masses as well as in innumerable dykes and small bosses which penetrate the older rocks. It evidently forms the principal rock south of Manigotagan river for a great part of its length. On the north, too, it forms a large batholith on the lower part of the river and also large masses, that are probably separate from one another, north of Gold lake and of Long lake."

"The granite is generally of medium texture, gray or flesh colored, and is in places gneissic. In places pegmatite veins and masses are large and numerous. Besides orthoclase and quartz there is a considerable proportion of plagioclase feldspar, with lesser amounts of hornblende and biotite."

As a result of an examination of the field in the vicinity of Long lake in 1917, Marshall throws some additional light on the relations of some of the principal formations of the area. He points out that in this vicinity there occur extensive bodies of porphyry which are intrusive into the older rocks and are intruded by granite, and which are probably fine-grained portions of the cooled granite magma.

It should be added that porphyritic border masses of the granite are fairly common in the district: those which are massive are easily differentiated from the older prophyries and lavas; but those which are schistose are not so easily separated. Some of the so-called granite of the Long lake area is free from quartz and is a typical hornblende syenite in appearance.

For detailed discussions of the formations of the district and descriptions of the types of rock, the reader is referred to the reports of Moore, Dresser and Marshall, which have already been mentioned.

Mineral Deposits

Up to the present time the only mineral deposits that have created much interest in the Rice lake district are the gold-bearing quartz veins. The occurrences of gold are well distributed throughout the mineral belt which, it has been pointed out, occupies an area of

Showing effects of glaciation in the Rice Lake District.

between 300 and 400 square miles. There are many general features common to the whole of the district and these will be dealt with before details are given about separate occurrences.

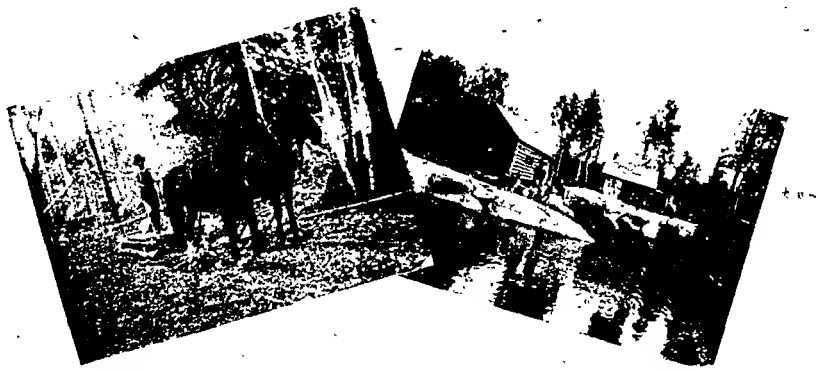
Veins of quartz carrying gold are found in practically all of the important formations of the district: notably in the schists of different kinds; also in granites and granite-like rocks which are typically much more massive than the schists.

The source of the gold has not been definitely proved, but there is strong evidence in some areas that the latest intrusion of granite has provided the minerals of the quartz veins, and as there is a great uniformity in the materials found in the veins throughout the district, there is good reason for inferring that all of the gold-bearing veins came from the same granite magma. The following discussion on the mineralogy of the veins will bring out the fact of this uniformity in mineralization.

Quartz is almost always present where gold values are secured and it typically forms the bulk of the deposits. With the bodies of quartz there is generally some mineralized rock, which in many cases would seem to warrant consideration when sampling is being done. Iron-bearing carbonate, which is probably largely ankerite, is a very common mineral; it is quite abundant in places and is found in nearly all deposits. Calcite is seen in some places. Pyrite is universally present; it and the ankerite vary greatly in their relative quantity, and each relatively to the quartz. Chalcopyrite is almost always found in small quantity; exceptionally it appears to be more abundant than pyrite and in a few

bodies it is quite prominent. The most important economic mineral is free gold. The best showings of this metal are in quartz, though it is seen in association with other minerals, such as pyrite, and in the mineralized country rock. The best free gold showings are in association with chalcopyrite as a rule. Pyrrhotite is conspicuously absent from the quartz veins. Arsenopyrite is rare in the district. Feldspar, generally a reddish weathering variety, is usually seen. White and green micas are common and in places are fairly abundant. A little black and gray tourmaline was observed in some deposits, particularly those in or near the parent granite. The more exceptional minerals are rare. A little molybdenite is found in a few of the quartz veins of the granite areas. Tellurides were not identified in any of the deposits. Galena and sphalerite are unusual and never abundant.

The mineral deposits of the district are not so uniform in form as they are in composition. Some are in the form of simple, filled cracks or fissures which were formed without much movement in the rocks. Others occur in narrow to wide bands of finely schistose rock produced by more or less extensive shearing movements. These sheared zones carry quartz masses which appear in many forms: large and small irregular masses, lenses of many sizes and forms and more or less continuous stringers and veins which commonly occur in parallel groups. Where there is no evidence of considerable movement, the veins are generally small, are apt to be crooked and are not traced for great distances. Where,



Construction on Summer Road, West of Rice Lake. *Store at northeast corner of Clearwater Lake.*

on the other hand, there was considerable movement, as indicated by the presence of very schistose rock, the deposits may be traced for great distances. Some of the veins occurring in the narrower sheared zones have been traced for 1000 feet and more. The wide sheared zones, which have widths as great as fifty or more feet and which carry more or less quartz, are traced for great distances, in some places across several claims. In parts of these sheared zones the whole width may be regarded as possible ore; in other parts they are apt to be very "tight" and the relative scarcity of quartz and sulphides in them makes these parts less attractive as possible ores. The bands of sheared rocks were formed by the movements of the rocks along certain zones, under such high pressure from the overlying rocks that they flowed, rather than cracked, under the force that produced the movement. In many places it is seen that rocks, which outside the zone of movement are quite massive, have flowed and have been squeezed into laminae like sheets of paper, in the band affected by the movement. It is difficult to convey in words a proper conception of the nature of these sheared zones as they appear at the surface; a glance at the accompanying photographs will make possible a better understanding of them. In some places the quartz is in fairly continuous veins; there may be several such parallel veins or stringers; one vein may fade out as another comes in at a different place across the zone. Typically the quartz masses are lenticular in form, thinning out rather abruptly at the ends and being relatively thick in the central portions. Irregular bodies of quartz frequently almost fill wide sheared zones for short distances. More particulars in regard to the forms of these bodies will appear in the descriptions of individual occurrences.

The zones of sheared rock served as channels for the ore solutions which brought in the quartz and its associated ore-minerals. These materials appear to have been largely deposited contemporaneously with the movements. In some parts the quartz was probably introduced without replacement by being forced in under high pressure; in other parts there is evidence of replacement of rock materials by quartz and other minerals, particularly carbonates. There is a gradual transition to be seen between the unaltered and the highly silicified schists that occur near to and as fragments in the quartz.

The period during which minerals were being deposited in the sheared zones was probably a very long one. Gold seems to be carried in small amounts very generally throughout the zones, but there is a marked difference in values in different portions. The quartz varies greatly in its texture and mineralization, even in the same deposit. It will probably be found that certain patches and bands of the zones have been enriched during a late stage in the period of deposition, and that the economic possibilities for each zone will be determined by the extent of this later enrichment. The smaller and richer deposits of the district, in the same way, were probably formed in a late stage.

Little beyond very general statements can be made in regard to the values in the gold-bearing deposits of the Rice Lake district. In contrast with the amount of development work that has been done in the area, the amount of careful sampling seems surprisingly small. Wonderfully rich pockets of free gold have been found here and there and very promising samples come from deposits in all parts of the district. The greater number of these rich pockets and samples come from the smaller veins, but excellent ones have been found in parts of some of the larger vein zones. While rich samples are encouraging, they must be supplemented by careful sampling of the whole mineral deposit before mining operations are warranted. Such sampling is the most pressing need of the district.

As a result of his examination in 1916, Dresser has this to say in regard to the distribution of values:

"Of one hundred and twenty-four samples taken from all parts of the district, though by far the greater number were from the Gold Lake and Long Lake localities, there were less than 10 per cent. that did not carry values above a trace. Therefore, gold seems to be widely distributed in the district; and this is more noteworthy as the total amount of prospecting and development of prospects is as yet altogether insufficient to show the value of the camp at all conclusively. Little information is available as to the length of ore chutes. Shear zones, and in places veins, persist for favorable lengths, but little seems to be known of the extent of the mineralization and consequently the possible supply of ore. The shearing of the veins augurs well for their continuance in depth but the values have not yet been proven far below the water level.

"Samples were taken from veins varying from five inches to ten feet wide. In these the values seem to be higher in the smaller veins. Thus the average value obtained from ninety-seven channel samples was $7 per ton, distributed as follows:

From veins 5 inches to 12 inches, average value of 33 samples $10.55.
From veins 13 inches to 36 inches, average value of 45 samples $ 5.97.
From veins 37 inches to 120 inches, average value of 19 samples $ 4.10.

"These figures, however, must be regarded as suggestive of this tendency, rather than as representative of all the actual occurrences that have yet been found. On the other hand the widespread occurrence of gold in the district warrants intensive search for higher values in larger quantities."

A few reports are available, containing the results of sampling in different occurrences. They show that some of the smaller veins have much higher values than Dresser's average for these would indicate, but they also substantiate his general estimate of averages for the whole district. It should be said, however, that thorough sampling has been done on very few properties and but a small number of the more attractive-looking large occurrences have been examined in more than a casual way. Each deposit should be considered on its merits and an average of values for many deposits, while it may be both interesting and instructive, is apt to be misleading when applied to individual occurrences. This statement is made all the more imperative, due to the facts that the district is still in its

Quartz in Sheared Zone on Pilot Claim.

Outcrop of Quartz on Gilbert Claim.

Outcrop of Quartz on Montcalm Claim.

Sheared Zone on Wolf Claim.

infancy in so far as thorough prospecting and developing are concerned, and that the gold-bearing area is being constantly extended by additional discoveries, some of which are just as promising or even more promising in the appearance of their outcrops than the earlier finds.

The first activity, it has been pointed out, centered around Rice Lake, from which the whole district gets its name. Attention was later directed to the vicinity of Gold lake. Long lake, which lies still further east, was the next locality to attract the prospector and about the same time several important discoveries were made in the neighborhood of Hay lake which lies to the north of Hole river. The latest finds of interest have been made in this last locality, also in the area south and southwest of Rice lake in the vicinity of Clearwater, Turtle and Jackfish lakes, and finally in the eastern part of the district around Bulldog (Beresford) lake.

While there are many features in common of the mineral deposits in the Rice Lake district as a whole, the great extent of the country in which gold is found, and the minor differences between the deposits in the several areas, make it desirable to treat the deposits in groups which will be referred to prominent localities. The areas will be described in succession from east to west, beginning with the Bulldog (Beresford) Lake area which is the farthest east.

Occurrences near Bulldog (Beresford) and Partridge (Moore) Lakes.

These lakes are in the eastern portion of the district, as it is now recognized, and are drained by the north fork of the Manigotagan river. Claims have been recorded in this locality for several years past but only recently have discoveries of note been made. The principal rocks of the area are schists, derived from fine and coarse-grained andesitic lavas, together with some areas of later granite. The schists strike generally about northwest-southeast. The deposits that seemed to merit most attention when the area was visited were on the Tinney claims which lie between Tinney lake and the north end of Bulldog (Beresford) lake.

Tinney Group—The most promising occurrence observed is on the Tinney claim which is about one-quarter of a mile from Tinney and from Bulldog lakes. The vein is in schist, parallel to the laminations of the rock which strike about north, 50 degrees west. At the widest part the vein is over 15 feet wide. This wide portion does not hold its width for great length: to the west it fingers out into narrow stringers; to the east it narrows and passes into low ground; and it gives evidence that it will not hold its width for great depth. What may be a continuation of this vein is seen in an outcrop several hundred feet to the east on the same strike. Here there is a sheared zone about 10 or 12 feet wide, one-third of which is quartz and the rest mineralized schist. Very little work had been done to trace the vein. The extent of the shearing indicates that the body will have considerable length and depth, but considerable work must be done on the surface to allow a thorough sampling. Good specimens of fine free gold are seen on the principal outcrop and the mineralization in much of the accompanying schist is such as to warrant its inclusion when the deposits are being sampled. The quartz in this deposit is largely of a sugary variety though glassy forms also occur. Pyrite is the principal sulphide; it occurs in both the quartz and the schist of the sheared zone. Chalcopyrite is common but it occurs in small amount.

Other outcrops have been found on the Tinney claims. Some of these are reasonably well exposed for several hundred feet. Most of them are exposed for only short distances. It is possible that many of these outcrops may be joined as they appear to be on the same strike, but intervening areas are often covered for such great lengths that stripping will be necessary to establish continuity. As is common to most of the sheared zones in other parts of the district, the quartz bodies are in stringers and lenses, some of which are quite wide but without great length.

On Tinney, No. 3 claim, there is an excavation on a contact between schist and fine-grained granite. A width of 15 feet shows considerable mineralization. The strike of the contact is about north, 10 degrees east. The contact is badly sheared and fractured

Sampling the Tinney claims near Tinney Lake, Rice Lake District.

and is cut by quartz veins and stringers. Considerable mineralization is indicated by the presence of much iron rust and some sulphides. There is such a continuous showing of rust in a wide and fairly persistent band along the contact, that a thorough sampling is warranted.

Since the time the area was visited some new discoveries have been made in the vicinity of the Tinney claims and also in a newer field on the east side of Bulldog (Beresford) lake. From the accounts that are at hand concerning these later discoveries, they are of such importance as to make this area still more attractive.

Some prospects were visited in an area to the west of Partridge (Moore) lake. Here were seen wide zones of shear, up to 25 feet in width but usually about 10 feet. The rock of this area is an andesite schist similar to that occurring near Bulldog lake. In some patches typical pillow structure was observed. The sheared zones are rather irregular, but fairly continuous, and are easily traced due to the laying bare of the rocks by recent forest fires. Quartz generally occupies a relatively small part of the zones. Where quartz is most abundant, the rock appears to be well mineralized. Pyrite is commonly distributed in quartz and schist and chalcopyrite and copper stains are also present. Ankerite and other carbonates are very prominent. The quartz is typically in narrow veins or stringers, but in places it is developed into wide masses without great length on the surface.

There is a stretch of country lying between Bulldog and Long lakes, which might be called the Stormy Lake area. There are several gold-bearing quartz bodies reported as occurring in this area, but as they were not visited, they cannot be described.

Deposits near Long Lake

The mineral-bearing rocks of this area are principally granites and syenites though some veins are found in other rocks, mainly greenstones and porphyries. Most of the discoveries have been made in the country between Halfway lake and the eastern end of Long lake. A few prominent masses of quartz have been located in areas adjacent to the west end of the latter lake.

The veins generally are found in relatively narrow sheared zones. Many stringers and veinlets of quartz carrying gold are found where there has been no shearing, but these are usually quite irregular and are not traced very far on the surface. The mineralization of the veins follows pretty closely that which was described for the whole of the Rice Lake district. Free gold is the prominent ore-mineral. Besides pyrite and chalcopyrite, the only sulphides noted were galena and molybdenite, which occur in small quantity.

There are many deposits located in this area but mention will be made of only a few of the more typical and promising ones.

Eldorada Veins—There are two prominent veins on the Eldorado group of claims besides some outcrops of lesser interest. They are typical quartz veins lying in relatively

narrow sheared zones in granite. One outcrop is traced fairly continuously for nearly 1500 feet in a sheared zone which varies in width from 2 to 10 feet with an average of about 4 feet; the quartz occupies roughly one-fourth of the zone. The other prominent vein is traced about 1000 feet; it occupies a sheared zone which averages about 2 feet in width and which has quartz in about the same proportion as the first deposit. Free gold showings are strong and well distributed along the outcrops of these veins. Quartz is fairly continuous as lenticular veins and stringers along the sheared zone, though here and there it pinches out for short distances. The sheared granite is commonly silicified and mineralized. Carbonate gangue minerals are present but not abundant. Pyrite is the most prominent sulphide; chalcopyrite is less evident and galena is rare. The veins have been stripped wherever possible and the surface has been opened in many places, so that they are in fair condition for sampling. Other outcrops have been found on the Eldorados but have not been traced so far as those just described. Molybdenite was seen in some of these.

Near Walton's Cabin—There are several veins, some of which have excellent showings of free gold, on a number of claims adjacent to the cabin. Quartz outcrops in considerable widths in many places, but the veins are not so well traced as in the case of the Eldorados and consequently the deposits are not so attractive in appearance.

Between Walton's and Stewart's Cabins—Several veins outcrop along the trails between these cabins. Most of them do not appear to be traced for great distances. Several different kinds of rock hold the veins in this section: among them, granite, syenite and a fine-grained diorite. The deposits are very similar to others in the area and need no special mention beyond the fact that small amounts of molybdenite are common in the quartz.

Near Stewart's Cabin—A pit, 15 feet deep, near this cabin shows a mineralized dike of porphyry contained in fine-grained diorite. The porphyry is cut by numerous veinlets of quartz and also shows ankerite and other carbonates, pyrite and free gold.

The Goldhill claim has a shaft which was sunk in a wide sheared zone which strikes northwest-southeast. Pyrite, ankerite, and stringers and irregular masses of quartz occur in the zone. Some of the quartz is smoky and some sugary. Free gold shows in the quartz and mineralized rock. To the southeast the deposit passes under muskeg; to the northwest it continues but does not appear to be so strongly developed as near the shaft: it narrows and while it shows quartz in some outcrops, in others it is absent across the width of the zone.

The deposits which have been described will serve to illustrate the type found most commonly in the area. There are many similar occurrences reported. Another type will be described in the following paragraphs.

Marshall spent some time in the vicinity of Long lake in the summer of 1917, and some of his observations on the economic geology of the area will be quoted:

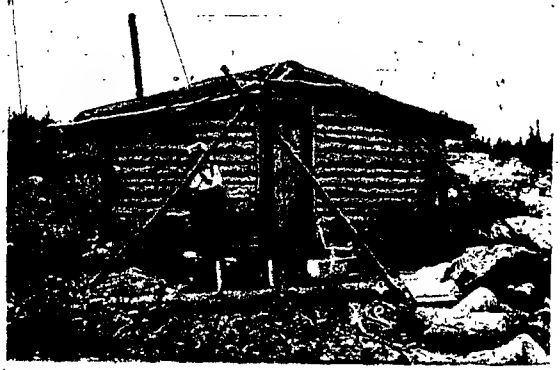
"In the Long Lake area the largest veins are in the granite and the outcrops of these show larger amounts of metallic minerals than those of veins in the other rocks. Northeast of the north end of Halfway lake there are large masses of quartz in the Keewatin rocks, but they are, at the surface at least, practically barren of metallic minerals."

"Numerous small veins and stringers of quartz occur in all rocks of the area. These, however, are very irregular in length and variable in direction. In width they vary from a few inches to 1½ feet."

"Two of the quartz masses of the area deserve special mention on account of their size."

"About one-quarter of a mile northwest of Walton's cabin, on the trail to Halfway lake, is a vein of quartz in the granite. The trend of the vein is southeast; its maximum width 8 feet. The mass can be traced on the surface for 400 feet, and throughout this distance it has an average width of 3 feet. Pyrite is the most abundant metallic mineral."

"About half a mile northwest of the west end of Long lake there is a mass of white quartz extending in a direction south, 55 degrees east. The mass can be traced on the



Steuart Cabin, Long Lake.

surface for 400 feet, and has throughout that distance an average width of 35 feet. To the east the mass disappears under the muskeg. To the west masses of quartz can be seen at intervals for another 400 feet. The vein contains chalcopyrite, with lesser quantities of pyrite and small amounts of bornite and arsenopyrite."

It should also be mentioned that there is another large body of quartz, similar to that just described by Marshall, which outcrops near the south shore of the west end of Long lake. From the outcrops examined, there would seem to be very few sulphides present and there is little evidence that values of importance would be present. Assays of samples of quartz from this body are said to have given traces and low values in gold.

Occurrences Near Gold Lake

There are several gold-bearing deposits in an area lying to the northeast of Clearwater lake and near Gold lake. The bulk of the more promising deposits are near Gold lake and here much of the development work of recent years has been done. The area is not sharply defined since deposits are found throughout the areas between Gold lake and the lakes farther west. Between Long lake and Gold lake, however, there is a considerable stretch of country from which no occurrences have been reported, this being due probably to the generally covered condition of that area.

The veins of the Gold Lake area are largely in schists which have been derived from porphyritic and felsitic acid lavas and from pyroclastics of similar composition. A few deposits are in granite, granite-gneiss and in porphyries which are border phases of granite intrusions. The veins are typically in narrow to wide zones of sheared rock. A few of the smaller veins are in fissures which were formed with little shearing of the rock; these are generally crooked and difficult to trace.

Beaver House, Elbow Lake.

The *Gold Pan*, *Gold Seal* and *Gold Pan Extension* are contiguous claims staked on the same vein, which has an outcrop that has been traced for nearly 3000 feet. It occupies part of the sheared zone, which varies from 1 foot to 8 or more feet in width. The outcrop strikes about north, 30 degrees west, and the vein is never far from vertical in position. The quartz is very irregular in amount in different parts of the zone. Lenticular masses are traced for considerable distances and show widths of from 2 to 3 feet; greater widths than this are exceptional.

The lenses, which get thinner towards the ends as shown on the outcrop, are commonly joined by narrow stringers or veins of quartz, though in some places quartz is absent from the sheared zones for considerable distances between the lenticular bodies. The quartz of the vein, as indicated by the outcrop and the underground workings on the three claims, varies typically between a few inches and 3 feet in width, with an average for the entire zone of less than 1 foot. This irregular and average narrow width will make it imperative, should values warrant mining, that the vein be worked in lenses and chutes and not throughout. The mineralized rock, found in the zone along with the quartz, varies typically from 1 to 3 feet. A good deal depends upon whether this rock would pay in milling, as much of it would have to be mined. The quartz shows irregular mineralization; in some parts there are no sulphides and free gold to be seen; in other parts there is a notable mineralization, commonly by pyrite, chalcopyrite and free gold, less commonly zinc blende and more rarely by galena. Some wonderful samples of quartz carrying free gold have come from the underground workings, particularly from the Gold Pan shaft; it is interesting that many of these rich samples show very few or no traces of sulphides, the pure gold occurring alone in glassy quartz. Elsewhere in restricted portions of the vein fairly rich free gold ore is found and the association of gold with chalcopyrite is marked.

Gold Pan—This claim is located on the central portion of the vein and a shaft has been sunk on the northwestern side of the property at a point on the vein where the prevailing country rock, porphyry schist, is cut across by a narrow basic dike. The occurrence of bodies or pockets of exceptionally rich gold-bearing quartz in this shaft has raised the question as to whether the enrichment is due to the presence of the dike. The question has not been answered satisfactorily. It is true that no ore as wonderful as that which comes from the shaft occurs elsewhere in the vein, but at the same time some fairly rich quartz has been found.

The shaft on the Gold Pan has been sunk to a depth of 191 feet from the surface. At this depth the lower levels were run, and at a point a few feet from the shaft a winze was put down to a further depth of 42 feet, making the total depth attained from the surface over 230 feet. The lower drifts are 300 feet to the southeast and 100 feet to the northwest. The upper level at 120 feet shows a drift 50 feet to the southeast and 40 feet to the northwest. The rich showings that were found in the sinking of the shaft have been pretty well gutted, though free gold was seen at several points in the underground workings. On the whole the dimensions of the vein underground are what would be expected from an examination of the surface.

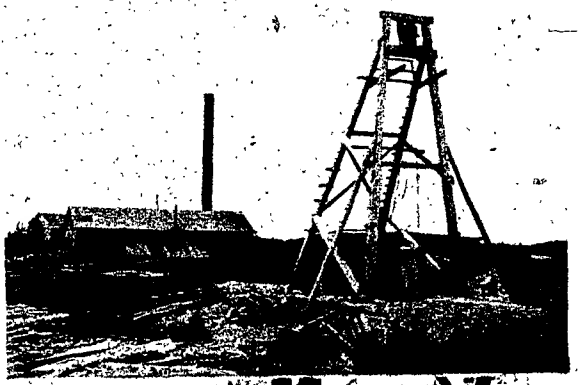
The Gold Pan property is equipped with two boilers having a total capacity of 75 horse-power, a 6x8 hoist, a 3-drill compressor and a small mill equipped with three small stamps and an amalgamation plate. The machinery is well housed and there are good camps for the accommodation of a small crew.

Operations ceased on the Gold Pan property in July, 1920, and the company which was developing it continued its development work on the same vein, on its adjoining property, the Gold Seal.

Gold Seal—The vein is stronger on the Gold Seal, particularly near the shaft, than on other parts of its 3000 feet of outcrop. In July, 1920, there was a shaft 53 feet deep with a cross-cut at the bottom of 14 feet to the vein, along which a total of about 80 feet of drifting had been done. The vein is relatively strong in the lower workings and shows an average width of about 18 inches of quartz. Free gold, pyrite, chalcopyrite and sphalerite are prominent in some parts of the vein.

Gold Pan.

Moose



Gold Pan Extension.

Gold Pan Extension.

The claim is owned by the Gold Pan Company and sinking operations are being continued in the original shaft by that company at the present time.

As in the case of the Gold Pan, the underground appearance of the vein is what would be anticipated from the surface outcrop.

Gold Pan Extension—The shaft on this property is sunk on the same vein that appears on the Gold Pan and Gold Seal claims, at a point about 225 or 250 feet to the northwest of the Gold Pan shaft. A good deal of the surface of this claim is covered by swamp, so that very little of the outcrop of the vein is to be seen. In July, 1920, the shaft was at a depth of 104 feet and sinking operations were being continued. The upper 45 feet of the shaft is vertical and the lower part dips at an angle of 85 degrees to the northeast. The shaft follows the vein, or where this is lacking, the sheared zone, which is well defined.

This property is well equipped with first-class machinery: a 70 horse-power boiler, a hoist and 4-drill compressor. There are good camps for the accommodation of the crew needed for ordinary development operations. In July, 1920, good progress was being made in deepening the shaft under the capable direction of Mr. J. Borthwick.

Moose—This claim and some others lying to the northwest of it are staked on a well-defined sheared zone, which in places, and particularly on the Moose, is quite wide, and shows a notable development of gold-bearing quartz accompanied by more or less mineralized schist. On the Moose claim the sheared zone is near an intrusion of granite, and some of the quartz veins of the zone continue from the porphyry schist into the body of granite. Veins of quartz, mostly lenticular, but some of them fairly continuous, occur in different parts of the band. In general they show some mineralization throughout, and here and there are portions showing considerable sulphides and free gold.

A good deal of development work has been done on the property. In 1916 a shaft was sunk on one of the larger and more persistent bodies of quartz to a depth of 100 feet and drifts were run on this level along the vein, 71 feet to the southeast and 108 feet to the northwest. The shaft follows the vein and dips between 70 and 75 degrees to the southwest. The quartz vein is continuous throughout the underground workings and has a width varying between 2 and 6 feet. A considerable amount of trenching has been done on other portions of the zone and the surface is in fair condition for sampling. Some portions, as viewed from the surface, appear to be more attractive for values than the vein on which the shaft was sunk.

The value of the Moose, and of several properties in the district which resemble it in having wide sheared zones which carry considerable quartz, would seem to depend on the values which are to be found in the mineralized schist which accompanies the quartz. In many cases the rock shows more sulphides than the quartz, though generally speaking the quartz has received most of the attention when sampling and development work were being done. If there are no values in the schist, the outlook for many of the large sheared zones, which have been found so far in the district, is not bright.

Josephine and Mildred—A wide sheared zone is traced across portions of these two claims. It strikes north, 17 degrees west. Throughout it is cut by quartz bodies which occur in a great variety of forms. Over 1000 feet is well exposed; some parts are naturally bare, others have been stripped.

The country rock is porphyry schist and the zone is typically between 20 and 30 feet in width. The quartz varies from 1 to 10 feet in total width across the zone; in some portions it is largely in one lens; in others it occurs in two or more veins or in many stringers. Sulphides are pretty well distributed both in the quartz and in the accompanying schist of the sheared zone; but they are strongly developed only in irregular patches and streaks of varying size. Pyrite is the principal sulphide. A little chalcopyrite is seen in places. Free gold is said to have been panned from several parts of the zone. Iron-bearing carbonates are abundant in the quartz and schist. Inclusions of porphyry in the quartz have been largely silicified and some of them have been replaced by carbonates.

Pilot-Smuggler.—The sheared zone, which is traced across these and adjoining claims, belongs to a type which is fairly common throughout the Rice Lake district. Some occurrences which belong to the same general type are: The Moose, Mildred-Josephine and several others in the Gold Lake area; the more prominent deposits of the Bulldog (Beresford) Lake area; the Tine, Montcalm and Wolfe deposits in the Little Rice-Elbow Lakes area; nearly all of the deposits in the vicinity of Rice lake, such as the Gabrielle, Goldfield and Ranger; and many of the deposits in the vicinity of Wanipigow lake, such as those on the Luleo and the Amisk claims. The Pilot-Smuggler lode, on account of its good natural exposure, and the stripping, trenching and other development work which it has received, is particularly well adapted to illustrate this common type of deposit, so that a detailed description of the lode, as it outcrops from end to end, will be given in order to save space in the description of the other occurrences.

The Pilot-Smuggler sheared zone has a strike of about north, 15 degrees west; it cuts across the general northwest strike of the schist of the surrounding country. The deposit is seen for some distance on the Canadian Girl claim; it is traced southeast across the Pilot, a corner of the Jumbo, the Smuggler and the Lucky Strike claims. The following is a description of the zone as it was viewed in passing over it from the Canadian Girl claim to the southeastern portions of its outcrop on the Lucky Strike.

The sheared zone is prominent on the Canadian Girl claim, and near the boundary of that claim with the Pilot, there is a wide band with considerable quartz. Near the boundary there is a pit, 10x8 feet on the surface and 10 feet deep, sunk entirely in the sheared zone and showing an average of at least 2 feet of quartz with prominent amounts of pyrite, less chalcopyrite, and considerable sulphide-bearing and silicified schist. The outcrop indicates that this condition holds for about 100 feet to the southeast and beyond this the quartz widens and 2 to 5 feet of it occur in a zone 8 to 9 feet wide. In the next few feet the amount of quartz becomes smaller and for a distance of 75 feet beyond it has a width of 1 to 3 feet in a zone 8 to 10 feet wide. Beyond this for 100 feet the quartz of the zone varies from 2 to 5 feet in width. Most of this quartz so far described is in one vein, but there are many side stringers in places with sulphide-bearing rock between the fissures. About 30 feet southwest of the point now reached on the zone, is a shaft 50 feet deep sunk on another vein which has appeared in the outcrop. The former vein continues beyond the shaft and at one place shows 5 to 6 feet of solid quartz together with some stringers. The shaft is sunk on a vein 4 to 5 feet wide. Southeast from the shaft a short distance there is a trench showing 5 feet of quartz and considerable mineralized schist in a width of 18 feet. Still farther there is 3 to 4 feet in 20 feet. Along these last-mentioned portions of the outcrop, the zone is fairly well mineralized by pyrite and chalcopyrite. Further southwest the wider veins disappear and the zone is occupied by numerous narrow stringers of quartz with more or less mineralized schist between the stringers. For some distance the quartz gets stronger in a very wide outcrop of the sheared rock; large lenses of white quartz associated with considerable quantities of iron-bearing carbonates become prominent. Of the next 300 feet, half is covered and quartz is not prominent in the exposed portion of the outcrop. Near the south boundary of the Pilot a 12x8 shaft has been sunk to a depth of 20 feet. At the shaft there is 4 feet of quartz in one lens with additional amounts in stringers occurring in a wide band. The dump from the shaft shows that the quartz contains considerable pyrite and chalcopyrite, and that the schist carries some sulphides. In a pit a short distance beyond the shaft the zone is seen to be fairly well mineralized and shows a total of 3 to 4 feet of quartz in 8 or 10 feet of schist. On the Jumbo claim, quartz is not prominent though shearing is pronounced. The best quartz showings for short distances are only 3 to 4 feet in total width. For a considerable distance on the Jumbo and the northwestern part of the Smuggler claim, the deposit is covered by overburden. Where the outcrop is first seen on the Smuggler, quartz is more prominent. In one pit 2 to 3 feet of quartz is seen in a width of 6 feet of poorly mineralized schist. Towards the south boundary of the Smuggler 5 to 15 feet of quartz occurs in two or three veins which are traced about 100 feet.

The sheared zone is traced across the Gold Pan trail into the Lucky Strike claim where 5 to 6 feet of quartz occurs in the best showings.

Portions of sheared zones, similar to but usually less prominent than those found on the Moose and Pilot-Smuggler, outcrop on some other claims in the country lying between Gold and Clearwater lakes.

The *Somme* and some adjoining claims which lie close to the trail from Clearwater lake to the Gold Pan claim, show several sheared zones, one of the most prominent of which lies in a *lit par lit* contact of granite and schist. On this zone, which is quite wide in places, there are numerous quartz stringers and lenses, the total width of which, however, makes a comparatively small part of the whole zone. Pyrite is fairly generally distributed but is not abundant. Iron-bearing carbonates are prominent.

On the *Eagle*, *Jumbo* and adjoining claims there are some sheared zones which are either not so continuous as some of those which have already been described, or have not been traced. At several points on these claims there are to be seen notable developments of well mineralized quartz in sheared zones which carry more or less sulphides. There are some prominent lenses of quartz, commonly from 2 to 10 feet in thickness on the outcrop.

In the area around Gold lake and between it and Clearwater lake there are many other occurrences of gold-bearing deposits. In the following paragraphs there will be found a mention and description of the more prominent of these. Most of them that remain to be described belong to the type represented by the Gold Pan, rather than to that corresponding to the Moose.

The *Commonwealth* claim has some outcrops of quartz in granite. Some good samples of free gold are said to have come from this property but no continuous outcrop of ore was seem. Chalcopyrite and pyrite occur in stringers and irregular masses of quartz, which are small and not traced for great distances. These sulphides also occur to a small extent in the mashed granite.

The *Exchange* claim, which is near the Commonwealth, shows an outcrop in a fractured zone of a fairly massive fine-grained porphyry. A total of 1 foot of quartz appears in a pit, 10 feet wide, where a mineralized zone, about 2 feet wide, carries pyrite, chalcopyrite, siderite and tourmaline. To the north of this outcrop, a tongue of granite cuts across the strike of the deposit which is not traced and probably does not continue for any considerable distance.

The *Irene* claim is close to Gold lake. In a pit a few yards from the lake a jointed porphyry is seen to be cut by stringers of quartz. The quartz and some of the associated porphyry carry pyrite, chalcopyrite and iron-bearing carbonates. The outcrop is noticed in some other places but the deposit is very irregular in form and size.

The *Capital* claim has a pit sunk in pegmatite, showing orthoclase and quartz, associated with pyrite and chalcopyrite which occur in relatively small amount. Some ochre appearing in streaks in the rock may have been derived from iron-bearing carbonates. The deposit is very irregular, as judged from the few outcrops observable.

The *Harry* claim has a fractured zone in granite, containing small stringers of quartz, and the whole containing more or less pyrite. The rock and quartz are said to give pannings of free gold. The deposit seems to be fairly continuous; it has been exposed for about 300 feet by stripping. A small pit in one place shows that about 8 feet in width of the rock carries some sulphides and is stained by copper carbonates.

The *Bruce Group*, including the Bruces, September Morn and Canada claims, lies to the southeast of Gold Lake, east of the Gold Pan and north of the Moose. There are several small, rich veins on these claims, some of them filling irregular fissures, and others following sheared zones, parts of which are well mineralized. The veins are largely covered and consequently not easily traced. On one of the Bruces there is a band of fractured granite, with no quartz but with a considerable amount of pyrite scattered through it, which carries small but interesting values in gold; it is an unusual type of deposit in the district and for this reason receives special mention. The veins of this group are mainly in granite. The

work which has been done on the claims is entirely surface work consisting of stripping, trenching and the sinking of test pits.

The *Brooklyn* claim has some narrow veins which are not well exposed on the surface. They follow sheared zones in porphyry and the quartz is rather irregular in width; exceptional widths are 2 feet and over, the veins being typically narrower than this on the outcrops. When visited, the underground workings were inaccessible. The work done on the claim consists of some stripping on the surface and the sinking of two shafts. One shaft is down 90 feet and has a cross-cut of 8 or 10 feet and a winze 20 feet. The other shaft is about 600 feet to the northwest of the first and is down to a depth of 35 feet.

The *Chicamon* claim has a poorly exposed outcrop of vein, showing in the best places 1 to 2 feet of quartz in a sheared porphyry schist. A shaft has been sunk to a depth of 80 feet; there is also about 60 feet of drifting and 40 feet of cross-cutting.

The *Nevada* claim lies a short distance to the north of the Gold Pan. Irregular bodies of quartz, showing notable quantities of pyrite and chalcopyrite, occur in a sheared zone. There is no evidence of a continuous body of quartz and the irregularity of the deposit is indicated by the fact that on the surface, where a shaft has been sunk to a depth of 15 feet, one side of the shaft shows 6 feet of quartz, while the opposite side shows practically none.

The *Pendennis* claim lies a short distance north of Clearwater lake on the trail from that lake to Little Clearwater lake. A small, rich vein of quartz has been exposed for a distance of about 200 to 300 feet. The quartz varies in width from a few inches to about 3 feet and occupies part of a sheared zone which is from 1 to 5 feet wide. Some of the rock of the zone is well mineralized and may carry values. Pyrite and chalcopyrite are abundant in the quartz and some of the schistose rock. The country rock near the vein consists of granite and coarse porphyry which are relatively massive. Free gold is very prominent in the quartz in most parts of the outcrop and in the material brought up from the shaft. At the eastern extremity the outcrop is lost under overburden and at the western end the vein pinches out. A trench 200 feet farther west shows a 6-inch vein which is on the same strike as the main vein and which may be in the same zone. A shaft has been sunk to a considerable depth. The property has good camps which could easily be made suitable for habitation.

There are many other claims in the Gold Lake area which are said to have gold-bearing veins but time did not permit the examination of them. It is believed that the most promising finds so far made in this area and the claims that have received notable development work have all been described. The area has not been exhaustively prospected and additional discoveries may be expected.

Occurrences Near Elbow and Little Rice Lakes

The rock found in the vicinity of these lakes consists mainly of schists derived from acid and intermediate, felsitic and porphyritic lavas. The laminations of the schist strike generally between an east-west and a southeast-northwest direction. Granites occur to the south of this area on Clearwater lake and to the west in the vicinity of Jackfish and Turtle lakes. The prominent occurrences of gold-bearing quartz are in wide sheared zones, some of which are parallel to the schistosity of the neighboring rock but most of which cut this at small angles. The sheared zones are well defined but are quite variable in width. The quartz of the deposits occurs in very irregular bodies which vary greatly in size and form. Many of the zones carry enough mineralized quartz and schist to make them attractive as possible ore producers. Little can be said in regard to the values contained in these large bodies, but it is certain that all of them carry gold, and good samples are obtainable from most of them. What this area needs more than anything else is a thorough sampling of the outcrops of some of the more promising occurrences. Many of the properties have been developed in such a way at the surface, by stripping and trenching, that they are in fair shape for sampling.

The *Tine* claims show a well defined and wide sheared zone which strikes about east and west and which has been traced across the greater part of two claims. About half of this length has been well exposed by stripping and the other half is in low ground. Quartz is prominent in the zone wherever it could be examined; it varies in total width across the zone between 2 feet and 10 feet, with an average of about 5 feet. The bulk of the quartz at any one place in the zone is typically in two or three veins, but in some places it is made up of many stringers. The schist of the zone contains sulphides in considerable widths. The total width of the sheared zone is commonly between 10 and 20 feet. Pyrite is very common in the quartz and rock and chalcopyrite is fairly generally distributed. Nothing is known concerning the values in gold carried by this deposit, but the outcrop indicates that it is well worth a careful sampling.

On the *Montcalm* and adjoining claims there are several prominent sheared zones, some of which are traced for great distances and show strong outcrops of quartz for considerable lengths. The greatest development of quartz on the Montcalm is seen where two sheared zones appear to cross at a small angle to each other. The quartz of the sheared zones appears in the outcrops as large irregular masses, large and small lenses and more or less continuous stringers and veins. Sulphides are generally present in small amount throughout the schist and quartz of the zones; they are prominent here and there in streaks and patches. The most common sulphide is pyrite; chalcopyrite is prominent in places and traces of it are very generally distributed. Where the sulphides are best developed, and even in some cases where they are lacking or almost so, good free gold showings may be seen. Values are not uniformly distributed, judging from the aspect of the outcrops. The deposits are so irregular that a description of the exact form will not be attempted. Some of the quartz bodies have very large outcrops. Parts of the sheared zone, several hundred feet in length, show a continual occurrence of quartz varying between 2 and 3 feet in total amount in the width of the zone. Over 20 feet of quartz shows in several places for lengths of 40 or 50 feet. In one place there is an irregular mass of quartz which has a width of over 50 feet. This body is close to other large outcrops with widths of between 15 and 25 feet, some of which are irregular bodies and others more or less continuous. This group of large outcrops is located near the place where the two sheared zones come together.

The general strike of the schist in the vicinity of the Montcalm claim is north 65 degrees east. Parts of the sheared zones follow this strike. The zones which cut across the strike of the rock are very irregular in direction. The irregularity of the deposits and the considerable covering of earth over most of them make it difficult to establish the structural relations between the many different outcrops. Considerable stripping has been done, but not enough to expose and define the outcrops. Though portions of the masses of quartz appear to contain little or no ore mineral, other parts are well mineralized. A good deal of the schist of the different zones contains sulphides and may carry values. The outcrops on the Montcalm and their continuations into other claims give the impression that the mineral-bearing zones are very large and that they might contain workable values. Though the thorough sampling of these bodies would entail considerable expense, the outcrops appear to warrant it.

The *Gilbert*, *Clappelow*, the *Bears* and other claims in the vicinity of the Montcalm and Tine have outcrops similar to, if not so striking, as those occurring on these claims. Nothing is known of the values contained in these deposits, but many of the outcrops, from their size and general appearance, would warrant some sampling.

On the *Wolf*, *Fisher*, *Yankee Girl*, *Martin* and adjoining and intervening claims there are outcrops of several sheared zones which nearly always carry some quartz and in considerable length show large masses of that mineral. Some of the zones have been traced across two or more claim lengths. The zones vary in width from a few feet to over 50 feet, with an average between 10 and 20 feet. As the zones are traced from end to end, the quartz is seen to vary greatly in amount in different portions. Some irregular masses of quartz have a width of from 20 to 40 or more feet; generally the amount in those bodies that are fairly continuous along a zone lies between 2 and 10 feet. In some portions of the

bands there is practically no quartz; in others the mineral occurs in stringers; and commonly there are two or three fairly continuous veins in different parts of the zone. The stringers and veins are typically well mineralized by pyrite, less chalcopyrite and considerable iron-bearing carbonate; the large masses are generally not so well mineralized, except in narrow bands and patches. Good showings of free gold are seen at several points on the outcrops and in the trenches and pits which have been made. As a rule, the mineral deposits make a better impression where opened up than they do on the natural outcrop.

At one point on the Wolf claim, a pit showed 15 feet of quartz occurring in a sheared zone about 40 feet in width. The quartz and adjacent schist are well mineralized in this place, and a width of 5 feet shows abundant pyrite, chalcopyrite and ankerite. Some of this ore was shipped to the Testing Laboratory of the Department of Mines at Ottawa. The returns from this shipment and recommendations for treatment are given below.

2572 pounds of ore were crushed, sampled and assayed. The following values for the ore were obtained:

Gold, 1.07 oz. Silver, 1.50 oz. Copper, 1.43 per cent.

Gilbert Cabin, Little Rice Lake.

As a result of milling tests, the following summary is given in the report:

"Over 60 per cent. of the gold values can be recovered by amalgamation, but a very small percentage of the silver values is recoverable by this method. The silver must therefore be for the most part in the form of the sulphide, and tabling or flotation is necessary to recover the silver and copper values. By amalgamation, tabling and flotation it is possible to make a 95 per cent. recovery of the gold and silver values and a 90 per cent. recovery of the copper values in the ore."

There is a great uniformity in the materials found in the sheared zones of the Rice Lake District and this method of treatment, suggested by Mr. Timm, of the Department of Mines, will likely be found to apply to all of these deposits.

The extent of the deposits which outcrop on the Wolf and neighboring claims, the general mineralization of the quartz and accompanying schist and the common occurrence of portions of the deposits which are rich in pyrite, chalcopyrite and free gold, together indicate that these deposits are worthy of a careful sampling and further surface developing to determine their possibilities.

There are many other occurrences of sheared zones carrying considerable amounts of quartz, located in the area near Elbow and Little Rice lakes. They are generally similar to the deposits already described and their possibilities would seem to depend on developments in connection with these.

Occurrences in the Vicinity of Turtle Lake

Some interesting discoveries have been made in a granite area lying to the north of Turtle lake. The deposits found here are of a different type from those which have been previously described. To the northeast of this area of granite are the schists which occur around Little Rice lake and which carry such deposits as those found on the Montcalm. Not far from Turtle lake are some claims, the Bears and others, located on areas occupied by schist; these carry sheared zones which are similar to those on the Montcalm, Wolf, etc., and which consequently need not be described.

The occurrences near Turtle lake, which need special description, are on the Apex, Eva and Falcon claims. They are found in a fairly coarse-grained granite. These are continuous well-defined veins occupying narrow sheared zones. Some of the veins strike about east and west; others north, 70 degrees west. The veins are relatively narrow. The quartz is of a hard sugary nature and is frequently banded parallel to the walls of the vein, due apparently to a fracturing or flow movement and the filling of the narrow planes of displacement by black mineralized streaks.

On the *Eva* claim there is a vein which strikes about north, 70 degrees west, and which has been traced for nearly 1000 feet, and in the greater part of this distance the vein has

Close view of Banded vein in Granite, north of Turtle Lake.

been exposed. The sheared zone varies in width from 2 to 10 feet and the quartz from a few inches to 3 or 4 feet. The average width of quartz for 800 feet is about 2 feet. The quartz of the vein is not heavily mineralized, but small amounts of pyrite and less chalcopyrite are fairly uniformly distributed. Free gold occurs, particularly where chalcopyrite is most prominent. Sulphides are observed in the laminated rock of the sheared zone in most places and values may be found in much of this material.

On the *Thora* claim there is a vein similar in character to that on the Eva. It has been traced for several hundred feet but has not so definite a strike, nor is it in such a well-defined sheared zone as the Eva. The quartz of the vein pinches out in places and where present varies from a few inches to 5 feet in width.

The *White Rock* and *Apex* claims have veins which are similar in many ways to those on the Eva and Thora. The quartz is less banded, is whiter and coarser and shows less uniformity in the distribution of sulphides than that on these other claims.

On the *Falcon No. 1* there is a vein similar to the Eva, occurring in a well-defined sheared zone in the granite. Sulphides are not prominent but are evenly distributed. The vein is traced intermittently for several hundred feet. The quartz averages 2 or 3 feet in width, and its texture and banding are similar to that found in the Eva vein. A similar

outcrop is found and exposed for a short distance in a locality 1000 or 1500 feet to the south-southeast of this one.

Occurrences in the Vicinity of Rice Lake.

It was in the vicinity of Rice lake that the earlier development operations were centred and for this reason the name is used for the whole district.

The rocks found outcropping in the vicinity of Rice lake consist largely of schists derived from lavas, similar to those found in other parts of the district which have been described, together with minor amounts of more exceptional types. The mineral deposits of the area are similar in most respects to those occurring in the vicinity of Little Rice lake; that is, they belong to the wide sheared zone type, carrying more or less quartz in veins, stringers, lenses and irregular masses. A few of the more prominent occurrences will be described.

Stripping and Sampling on Gabrielle.
New Gabrielle cabin.

On the *Gabrielle* claim, considerable underground work was done a few years ago. A deposit near the shore of Rice lake shows a fairly wide outcrop of mineralized rock containing many intersecting veinlets of quartz. The deposit is very irregular and as it passes into the lake at the east end and under cover at the west, it is difficult to determine its attitude. There is some evidence of shearing in this deposit, but the lode materials indicate brecciation, rather than flowage, in the rock of the mineral-bearing zone. Pyrite is present

in the quartz and is even more prominent in the rock materials of the deposit. Ferriferous carbonate and reddish-weathering feldspar are very generally distributed. There is also some gray and black tourmaline. A shaft was sunk on this deposit to a depth of 52 feet, at which level a curving drift was run for 38 feet.

The most prominent outcrop on the Gabrielle is a well-defined sheared zone which strikes about north, 40 degrees west. The schistose porphyry, in which the deposit lies, has a prevailing strike in the vicinity of nearly east and west. The sheared zone is occupied by schist, which is more or less mineralized, and by a succession of bodies of quartz, which occur in many forms. The typical quartz outcrop suggests a fairly regular vein or lens; these are usually traced for 100 or more feet. In places there are many parallel stringers and some irregularly shaped outcrops. The outcrop is traced intermittently for several hundred feet. The sampling widths of quartz and sulphide-bearing schist vary generally between 4 and 10 feet, with an average of about 6 feet. The minerals found in this deposit are practically identical with those mentioned for the other. There is less evidence of fracturing and more of flowage in this body. A shaft was sunk on this deposit several years ago to a depth of 66 feet. At the bottom there is a cross-cut of 4 feet and drifts; one to the southeast for 12 feet and one to the northwest for 60 feet.

New camps were erected on this property during the past year and a little surface development was done. Recent sampling indicates that gold is fairly uniformly distributed throughout the deposits but that values are a little too low to allow a profitable exploitation under the adverse transportation conditions that have faced the Rice Lake district up to the present time.

On the *Goldfield* there is a wide and much buckled sheared zone in feldspar porphyry. It strikes north 55 or 60 degrees west. The zone is filled with more or less mineralized schist and quartz which occurs in sets of parallel stringers, cross stringers, lenses and more or less continuous veins. The minerals of the deposit are similar to those in the Gabrielle. Cubes of pyrite are abundant in some portions of the schist. The outcrop is traced intermittently for several hundred feet and the sheared zone is wide. Sampling widths would vary between 2 and 20 feet. There is a shaft 75 feet deep on the lode, but that and the 40 feet of drifting that is said to be done were not accessible. The property was well equipped at one time but most of the machinery has been removed to other properties in the district. A small mill building contains a two-stamp mill, amalgam plate and sluice box with riffles.

On the *Gold Cup* a shaft has been sunk to a depth of 70 feet on a sheared zone similar to the others in this area.

The *Independence*, *Big Four* and other claims in the district have considerable underground work done. In most cases the surface is not well exposed and the underground workings are not accessible, so that little can be said of them beyond the statement that materials in their deposits are of the same general nature as those of the Gabrielle and Goldfield.

The *Ranger* lies to the southeast of Rice lake, towards Gold lake. This claim has a sheared zone striking about north, 30 degrees west, in a felsite schist. The zone is fairly wide but varies greatly in width and direction. Veins and lenses occur alone or in groups in the zone; they are typically from a few inches to 2 or 3 feet in width and not very continuous. Pyrite and ferriferous carbonates are well distributed in the quartz and accompanying schist. Sampling widths would run between 1 and 4 or 5 feet. A 60-foot shaft has been sunk but was not accessible. The dump from the shaft indicates that it is largely outside of the sheared zone, as it shows very little quartz or schist from the zone.

There are many other claims located in the Rice Lake area, but so far as can be learned, the most promising occurrences, and those on which the most development work has been done, have been described, and the other discoveries belong to the same general type. As in most other areas of the district, there is much country remaining to be thoroughly pros-

pected on the surface. The general impression one gets in the vicinity of this lake is that the district would be farther ahead had there been less inclination to explore at depth and more to adopt the cheaper method of exploring the surface.

Deposits in the Country Tributary to Wanipigow River.

Several deposits were examined in the country near Wanipigow river and lake. Of these only one, on the York claim, was on the south side of the river; the others to be described are all located on the north side at some distance from the river. There are several occurrences in the vicinity of Hay lake which were not visited through lack of time, but which probably rank in importance with many that are mentioned.

The *York* claim is located on the new summer road, only a short distance from Gold creek. On the claim, which is mostly covered, there is an outcrop of a sheared zone which has been exposed for a short distance. The rock here is schist derived from a porpyhry of intermediate composition. A pit has been sunk to a depth of 8 feet, exposing a width of from 2 to 8 feet of quartz with some mineralized schist. Iron-bearing carbonates are more

Goldeye Lake near mouth of Wanipigow River.

Hole R. Indian Reserve. Wanipigow River.

prominent than sulphides and doubtless account for a good deal of the ochre seen at the surface. Pyrite is not abundant. Copper stains indicate the presence of small amounts of chalcopyrite. Insufficient stripping had been done to indicate the continuity of the deposit.

The *Luleo* claim is located about three miles to the north of Wanipigow river and a few miles to the northeast of the east end of Wanipigow lake. The deposit is in a coarse hornblende granite which has been sheared in a wide zone striking about northwest. About 300 feet of the vein has a width of quartz averaging between 20 and 30 feet. What are apparent continuations of the vein are picked up at different distances from the outcrop mentioned. One of these is to the southeast across a swamp at a distance of 700 or 800 feet. In no place was an outcrop seen as prominent as the one mentioned.

A shaft has been put down to a depth of 135 feet and at this level a cross-cut was driven 50 feet, 17 feet to meet the vein and 32 feet across it. Near the shaft the outcrop shows 26 feet of quartz separated into two parts by a horst 10 feet wide. This horst is not encountered in the cross-cut, where there are 32 feet of quartz. The quartz contains variable amounts of pyrite and some chalcopyrite. The sulphides are very unevenly distributed; in some bands there is a notable amount; in other wide portions sulphides are practically absent. In places the schistose granite of the zone contains considerable disseminated pyrite.

The property is well equipped with buildings and machinery. There are two boilers of 75 and 60 horsepower, a 3-drill compressor, a hoist and a 20-stamp mill which has not been set up.

In the vicinity of the Luleo many other claims have been staked but very little work has been done on most of them. There are many deposits similar to, but less prominent than, the Luleo.

The *Pine Ridge* claim lies to the north of the Luleo. It has a sheared zone in granite, striking north, 40 or 50 degrees west. Stringers and irregular masses of quartz make up about one-fourth of the mass of a 30-foot zone. Carbonates are prominent constituents and are found chiefly in the granite schist. Sulphides are fairly well distributed but are not abundant. The deposit is traced for about 100 feet and is not so strong at the ends.

The *Pine Ridge* claim, *No. 2*, has an irregular vein in granite. It is quite crooked but has a general strike of north, 20 or 25 degrees east. Pyrite is the only sulphide noted; it is less prominent in the vein of quartz, which varies from 1 to 5 feet in thickness, than in the adjacent schistose granite. The quartz is sugary and the vein in this and several other respects suggests a likeness to some of the veins occurring in granite near Turtle lake.

The area lying to the north of the east end of Wanipigow lake is largely occupied by granite, though some narrow bands of schist are seen here and there. Some of the more noteworthy of the claims in this locality will be described.

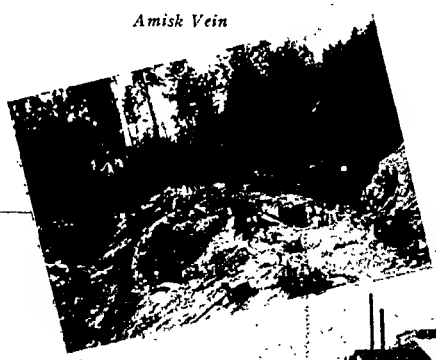
The *Tamarac* claim is less than a mile from the east end of Wanipigow lake. A pegmatitic quartz vein about 4 or 5 feet in width occurs along a contact between granite and dark-colored schist. The outcrop strikes about east and west. Pyrite and chalcopyrite are the prominent ore-minerals. The outcrop has been uncovered for about 40 feet and is fairly uniform for this length. There is little evidence of shearing in connection with the formation of the deposit, but there seems to have been some fracturing preceding the deposition of some, at least, of the sulphides.

The *Victor* claim lies to the north of the Tamarac. Here there is a prominent sheared zone occurring in granite close to a body of schist. In one pit there is exposed about 6 feet

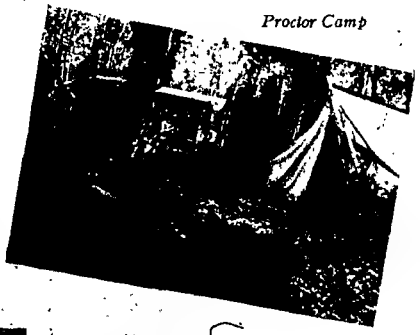
Rapids on Wanipigow River

of quartz and schist, both well mineralized with pyrite and a little chalcopyrite. Iron-bearing carbonates are prominent. In another pit there are 4 or 5 feet of quartz in 12 feet of schistose granite, which is partly mineralized. The deposit has been stripped for 50 feet; it should be fairly continuous.

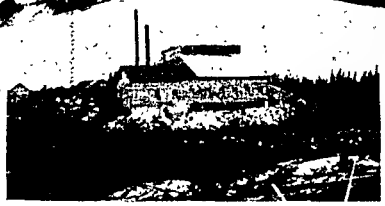
The *Roderick* claim shows an outcrop which has been traced intermittently for several hundred feet along a contact between sheared greenstone and granite. The deposit strikes about northeast. A series of pits shows a vein of quartz from 1 to 2 feet wide, accompanied by stringers and some more or less sulphide-bearing schist. Pyrite and some chalcopyrite are fairly generally distributed throughout the band.



Amisk Vein



Proctor Camp



Lulco Mine.

Views near Wanipigow River and Lake.

The *Proctor* claim has a deposit exposed for a length of 40 or 50 feet. It is part of a sheared zone in granite, which shows two parallel veins of quartz in the greater part of the outcrop. One of these veins is about 2 feet and the other 3 feet in width. At one end the quartz is in a solid mass about 8 feet wide. The quartz and accompanying schist are well mineralized with pyrite, chalcopyrite and free gold. Feldspar, iron-bearing carbonates and tourmaline are accompanying minerals. The whole zone is about 12 or 15 feet wide. This outcrop suggests that further development work might prove to be worth while.

The *Amisk* claim has one of the most promising looking outcrops in the Rice Lake district. Very little work has been done on the claim but there is sufficient to show that the deposit is fairly continuous. In the best part of the outcrop there is about 8 feet of quartz in one body. There is some mineralized schist with the quartz. This is the only deposit seen in the district that has more chalcopyrite than pyrite or that has sufficient copper to make that metal a considerable portion of the value to be expected from the ore. The deposit occurs in a wide sheared zone in the granite and strikes about north, 40 degrees east. There is such a general and abundant distribution of sulphides throughout the zone as to suggest that the whole band should be included when the deposit is being sampled.

Deposits on Lake Winnipeg Near the Mouth of Wanipigow River.

As Lake Winnipeg is approached after leaving Wanipigow lake, the country near the river is seen to be more covered by soil and drift than it is farther inland. No prominent deposits have been located between these lakes. On the shores and neighboring islands of Lake Winnipeg, however, there are good exposures of rock and some occurrences of mineral are worthy of mention.

The *Copper King* location is on the shore of Lake Winnipeg, 2 or 3 miles from the mouth of Wanipigow river. A sheared zone occurs in granite gneiss. It strikes parallel with the shore line, between north 10 and north 20 degrees west. Quartz, calcite and iron-bearing carbonates, pyrite and chalcopyrite occur in stringers and disseminated in the zone.

The outcrop is not well defined or traced and the shaft was not accessible, so that a thorough description of the deposit can not be given. The quartz lenses and stringers, as seen on the outcrop, vary from a few inches to 1 foot in thickness. The band showing pronounced mineralization appears to vary from 1 to 3 feet. Chalcopyrite is the prominent ore-mineral in the dump. Small picked samples of the ore were judged to run between 5 per cent. and 10 per cent. in copper. Larger pieces, from 6 to 12 inches in diameter, would carry 1 per cent. to 3 per cent. The vein stuff generally suggests that it would carry about 1 per cent. of copper. It is clear that the deposit should carry considerable values in gold and silver to make it attractive. A variable amount of sulphides is seen in the schist at several points, indicating that considerable work would be necessary to define the ore-body.

The property is equipped with camps. A core-drill, of the shot type, is set up and some drilling has been done. The location of the deposit is almost ideal for mining operations.

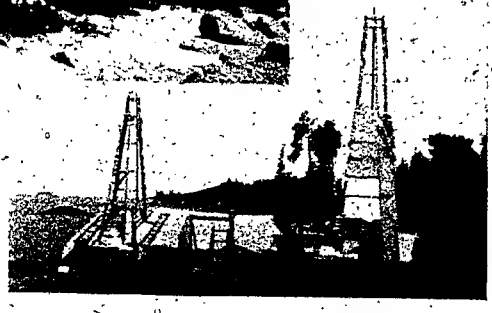
Some work was done several years ago on gold prospects located on the shore of Lake Winnipeg in this vicinity. Interest in these occurrences seems to be lost and they were not examined.

Asbestos of the amphibole variety occurs on some islands not far from the Copper King location. The size of the deposits, the low price paid for the material, and the mining and marketing difficulties combine to make the deposits unattractive.

Outcrops of *Winnipeg Sandstone* are seen on the east side of Black island. The bed is almost horizontal and has a thickness of at least 40 or 50 feet. The upper portion consists of a very pure quartz sand and is almost pure white in color. The lower few feet, as seen in the outcrop, contains considerable limonite and has a deep yellow or brown color.

In a pre-Cambrian outcrop of schist on the same island, there is an occurrence of hematite associated with calcite. The outcrop does not suggest a very large deposit, but exploration in the area might bring to light some workable deposits. The hematite in this deposit occurs in small concretionary masses, which are typically about the size of peas.

Winnipeg Sandstone, Black Island, Lake Winnipeg.



Copper King Mine, Lake Winnipeg.

Transportation

Rice lake is only about 100 miles distant from Winnipeg, and the nearest railroad points are only 50 to 75 miles away. Supplies are taken into the district during the summer months by means of large boats on Lake Winnipeg to the mouths of Manigotagan and Wanipigow rivers, thence by canoe up these rivers. The portaging that is necessitated by the numerous rapids and falls of these waterways makes it next to impossible to transport machinery or heavy supplies, and the expense of carrying even the lighter necessities is great. The Provincial Government has had a party in the field during the past summer and fall, engaged in the construction of a summer road to run from a point on Wanipigow River into the centre of the district. By means of large boats on Lake Winnipeg, smaller power boats on Wanipigow river and wagons on the summer road, it is expected that comparatively cheap transportation will be available for most of the mineral-bearing areas.

Transportation in winter time offers a simpler problem. So far all machinery and heavy supplies have been shipped into the district on sleighs. Winter roads have been cut from Fort Alexander, on Winnipeg river, and from the mouth of Manigotagan river, to serve as trunk roads for the several camps.

The district is still handicapped by being cut off during a month or two in each spring and fall, during the breaking and freezing spells of those seasons. On the whole, the transportation problem for the district, as a prospect area, has been solved. It remains to be seen what developments in the way of wagon roads and railroads will be forced by the actual or prospective operations of the district.

Summary and Economic Aspect

In the history of mining development in Manitoba, the Rice Lake district wears the aspect of an old camp. It has received attention for a period of only nine or ten years, four of which were the years of the war. This is a comparatively brief time for the development stage of a mining district. Many mining camps have reached the producing stage in a briefer time, but many others, and some of the greatest, required many more years. To some the district appears as one which has gone through all its stages and which has not been proved. This attitude is decidedly unfair, as the district is still, relatively speaking, in an early prospective stage. To one passing through and impartially examining the whole district, it is apparent that there is a huge area of attractive prospecting ground, containing some possibilities in the deposits already located in its smaller areas and greater possibilities in its unprospected, larger areas.

In forming an estimate of the possibilities the district has of becoming a gold producer, the following statements will be worth considering:

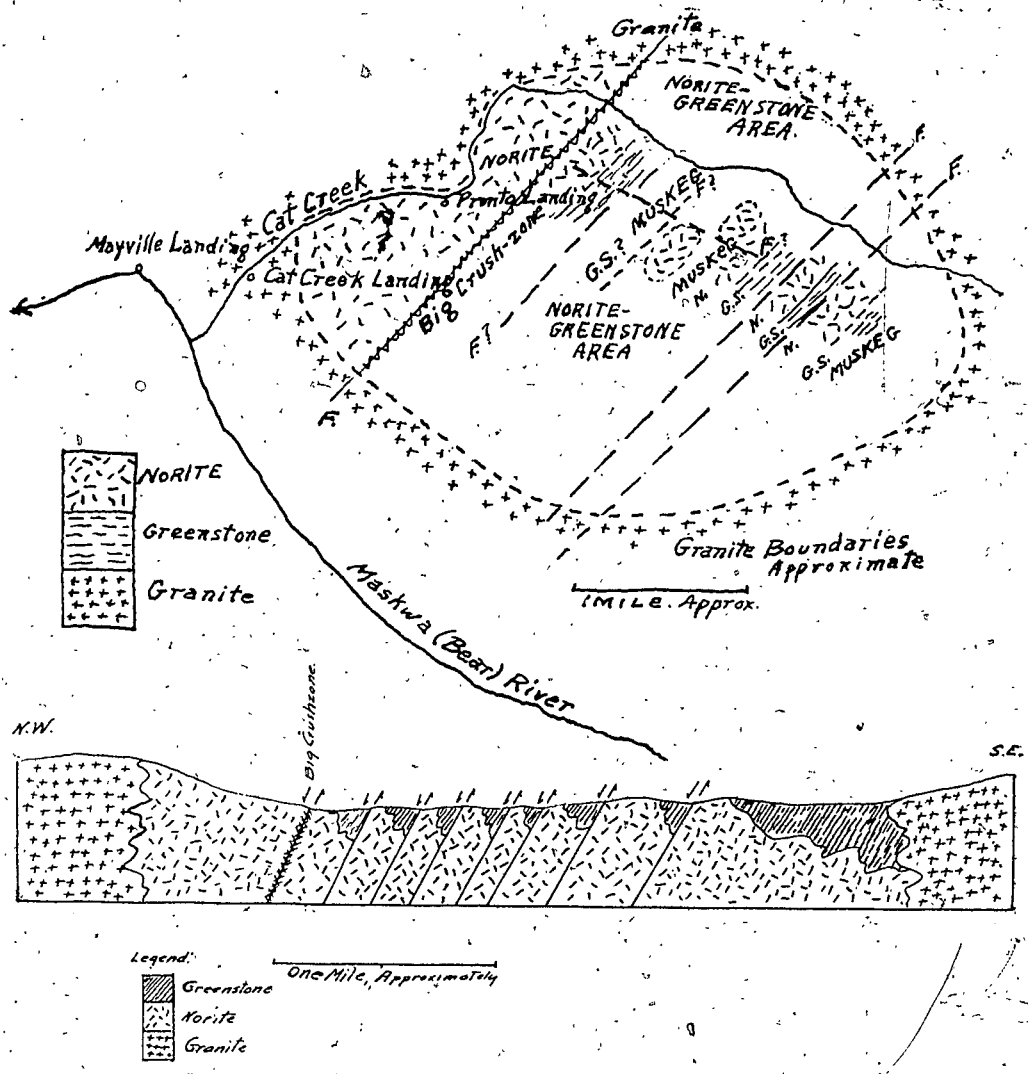
The area showing gold is a large one; it is growing year by year through the finding of fresh outlying fields; and new finds are being constantly made in the older portions of the district. Hundreds of different deposits yield attractive samples of free gold.

Though considerable work has been done on several claims, no property has as yet the rank of a producing mine. In this connection it should be stated that the best surface showings are not in all cases the ones that have received the most attention.

Among the factors that have prevented development work and possibly production, one that should receive considerable weight is the lack of transportation facilities, from which the district has suffered.

It is unfortunate that a great deal of the district has been held back from the attention of prospectors, owing to the staking of so many claims for "location," but there is a great deal of open country left and in most cases unprospected claims could be examined, possibly with profit, by arranging terms with the holders.

In conclusion, it might be stated that the general impression left after an examination of the district is that it will be surprising if in future years the Rice Lake district is found to have no workable gold deposits. The duration of these years will be lessened if a spirit of co-operation is fostered and active steps are taken to check exaggerated stories and illegitimate promotions, both of which have done the district an infinite amount of harm in the past.



Map and Section of Maskwa River District
(From Dr. Colony's Drawings)

CHAPTER III.

MASKWA RIVER DISTRICT

Introduction and History

Attention was attracted to this district during the winter of 1917-1918, the first claim having been staked on December 17th, 1917. A copper and nickel-bearing deposit on this claim is said to have been known to an Indian named Abraham, a resident of Fort Alexander, during a period of 25 years which preceded the staking, and it was he who directed the first locator to the occurrence. The report of the finding of nickel and copper near Maskwa river attracted a few prospectors to the district, and in the years 1919 and 1920 many more claims were staked. Several of the locations have mineral deposits, which, like the original one, show chalcopyrite and nickeliferous pyrrhotite disseminated through norite and schist.

Until the nickel-copper deposits were found near Maskwa river, it was generally supposed that the area between Lac du Bonnet and the Rice Lake District was occupied altogether by granite. It is interesting to know that there are other rocks in this area.

On Maskwa River. Typical Rock Outcrop on right.

and the occurrences near Maskwa river suggest the possible existence of other important non-granitic areas in sections which are away from the beaten paths.

Location and Means of Access

The Maskwa River area is shown on the index map to be in that portion of the province which lies between Lac du Bonnet and Manigotagan lake. The district is reached in canoes, by ascending Winnipeg river from its mouth at Fort Alexander, or by descending it from Lac du Bonnet or Grande du Bonnet Falls to the mouth of Maskwa river, thence by ascending this small river, a distance of about 30 miles, to a trail, 4 to 6 miles long which leads into the prominent mineral occurrences. There are 18 portages and a few lineups, necessitated by an equal number of falls and rapids on Maskwa river. It requires about one and one-half days to ascend this river and a long day to descend.

Surface Features

The surface of the country along Maskwa river, and in the neighborhood of the mineral deposits, wears the aspect of a typical glaciated pre-Cambrian area. Small hills and ridges of rock rise above the intervening lower areas, which are covered by varying thicknesses of glacial drift, muskeg and vegetation. The elevations are lower and outcrops of rock fewer as Maskwa river is descended and Winnipeg river approached.

The country is well forested and there are few signs of recent forest fires. Excellent pulpwood is seen along all stretches of the river, and some large spruce and other trees suitable for lumber, occur in considerable areas.

The country in the vicinity of Maskwa river seems to be largely occupied by outcrops of granite and granite gneiss. A small area which lies between the forks made by Maskwa river and its tributary, Cat creek, is occupied by norite and greenstone. These rocks are found in an outcrop, roughly elliptical in form, which has an area of between 15 and 20 square miles. Time did not allow a careful examination of all the rock outcrops of the area, but a cursory trip over the field made it apparent that: (1) the granite intrudes and is younger than the greenstone; (2) the norite intrudes and is younger than the greenstone, and (3) the freshness and generally more massive appearance of the norite suggests that it is younger than the granite. Dr. Colony, whose paper is quoted at length in the following pages, concludes that the norite is intrusive into both granite and greenstone and that it is consequently the youngest rock of the area.

The formations are tabulated:

Greenstone Schist (oldest formation)
(Intrusive Contact)
Granite and Granite Gneiss
(Intrusive Contact)
Maskwa River Norite (youngest formation)

A glance at Dr. Colony's sketch map of the area, which is reproduced in the bulletin, shows that the outcrops of norite and greenstone schist indicate an interbanding of these two formations. The bands of schist which occur in the intrusive norite may be regarded as the remains of roof pendants from an original overlying body of schist, or as having been produced by faulting. Dr. Colony has represented them as belonging largely to the latter type, in the sketch which illustrates his interpretation of the geological section.

Norite predominates over greenstone in the northwestern half of the outcrop; the schist, on the other hand, predominates on the southeastern side.

The following extracts from Dr. Colony's report are added:

"The ridges within the norite area are in part norite and in part greenstone; many of them are composed of both norite and greenstone, the contact between the two being in some cases obviously igneous, tight and sinuous in the extreme, the greenstone in such cases exhibiting strong injection and soaking phenomena.

"In other places both norite and greenstone are so strongly sheared as to suggest fault-contact rather than igneous . . . That more or less faulting has occurred is certain, and the writer judges that the faults are either strike-faults, or else they cut across the general trend of the ridges at very low angles.

"A crush-zone of considerable length, striking with the ridges, may be traced from some distance northeast of the Anaconda claim (in the western end of the area) to as far as the Rio Tinto, and possibly beyond. On the Anaconda claim the crush-zone is about 150 feet wide, and on the Terra, on an 'island' in the muskeg, it is about 250 feet wide."

Mineral Deposits

The most important deposits of the district have their values chiefly in copper and nickel, which occur in the sulphides, chalcopyrite and pyrrhotite, respectively. These minerals are found disseminated in grains, veinlets and small irregular masses in wide irregular bodies of fractured norite and greenstone. The deposits showing the greatest mineralization appear to be in the finer-grained and more basic portions of the norite, which are typically along contacts with greenstone schist. However, the sulphides are found in other forms of the norite, in schist in some places and in crush-zones having no connection with contacts. Indications are that the norite, being later than and intrusive into the schist, is the source of the ore minerals, and that by a segregation of materials in the cooling norite magma, the sulphides were made more or less available for concentrations along contacts or in fracture zones, which were open for circulation during the late stage in the cooling process.

Group in Copper-Nickel Area, Maskwa River, 1920.

Falls on Maskwa River.

Outcrop on Hilitrite Claim, Maskwa River District.

The following quotations with reference to the mineral deposits are taken from Dr. Colony's paper:

"The ore minerals are magnetite, ilmenite, pyrrhotite and chalcopyrite, all closely associated and intergrown. So far as a time relation can be made out they are all of a late magmatic stage . . .

"They occur in blebs, in irregular patches, stringers and veinlets, lying in, surrounding, cutting and replacing the silicate minerals of the rock, and penetrating cleavages . . .

"The 'ore,' therefore, is merely a mineralized phase of the norite itself. The ore minerals of economic value are chalcopyrite and nickeliferous pyrrhotite, distributed, with a little magnetite, ilmenite and pyrite both in disseminated grains throughout the norite, and more especially, segregated along the igneous contact between the greenstone and the norite, where mineralized zones occur up to 150 feet in width (at the surface).

"Various assays have been made of samples taken from different localities, and the maxima and minima are here given.

	Copper per cent		Nickel per cent		Platinum Metals Oz.	
	Max	Min	Max	Min	Max	Min
Maskwa River—Norite	3.60	0.68	1.68	0.29	0.03	0.01

"The writer has called this norite the *Maskwa River Norite*: judging by (*a*) its character and origin, (*b*) its extent, (*c*) its striking similarity to the Sudbury norite, (*d*) the occurrence of mineralized zones and the assay returns on these, it seems reasonable to state that this body of igneous rock and its 'ore' compare very favorably with, and is strikingly similar to, the occurence at Sudbury."

Several claims were examined in the area. The most striking occurrences of mineral to be seen in the summer of 1920, were on the Mayville and Hititrite claims. An extensive outcrop, showing disseminated chalcopyrite and pyrrhotite, is exposed on the natural surface and in shallow trenches, on each of these claims. The boundaries of the outcrops are not well defined and the attitude of the deposits is not very evident. In most places there is evidence of a gradual transition from rock which is rich in sulphides to that which is only slightly mineralized. Much work is required to allow an estimate of the size of the outcrops and a valuation of the deposits. It will be sufficient to say that there is a wide and fairly continuous, though irregular, outcrop of mineralized norite on each of these claims, which carries percentages of metals between the maxima and minima, as quoted from Dr. Colony's paper.

Several other claims which are located in the area show outcrops of rock, similarly mineralized, and, no doubt, more deposits will be found eventually in the area.

It is difficult for many reasons, to make anything like a positive statement in regard to the economic possibilities of the district. The country is heavily timbered and deeply drift-covered, except on a few hills and ridges. The two most promising outcrops of mineral, which were seen, are on knolls, which are cut off in either direction by covered ground, so that tracing on the surface is next to impossible. Very little work has been done to open up the deposits, and as they are of an irregular type in form and attitude, it is difficult to conjecture much in regard to their continuance. The outcrops are such, however, as to warrant a thorough investigation. The contacts and crush-zones appear to be well mineralized, and sufficient concentrations are apt to occur on portions of these to make them attractive as mining possibilities.

Stripping will be difficult, and this method of exposing the outcrop will not likely be sufficient to put the deposits on a measurable basis. It may be necessary to sink shafts or to resort to diamond drilling to prove their worth.

The Maskwa River District, while still rather inaccessible, on account of the difficulties encountered in navigating the river, and the lack of winter roads, is fortunately situated, in the event that mining devlopments are warranted. The district is relatively close to railroad points at Grande du Bonnet and at Point du Bois, and could easily be reached

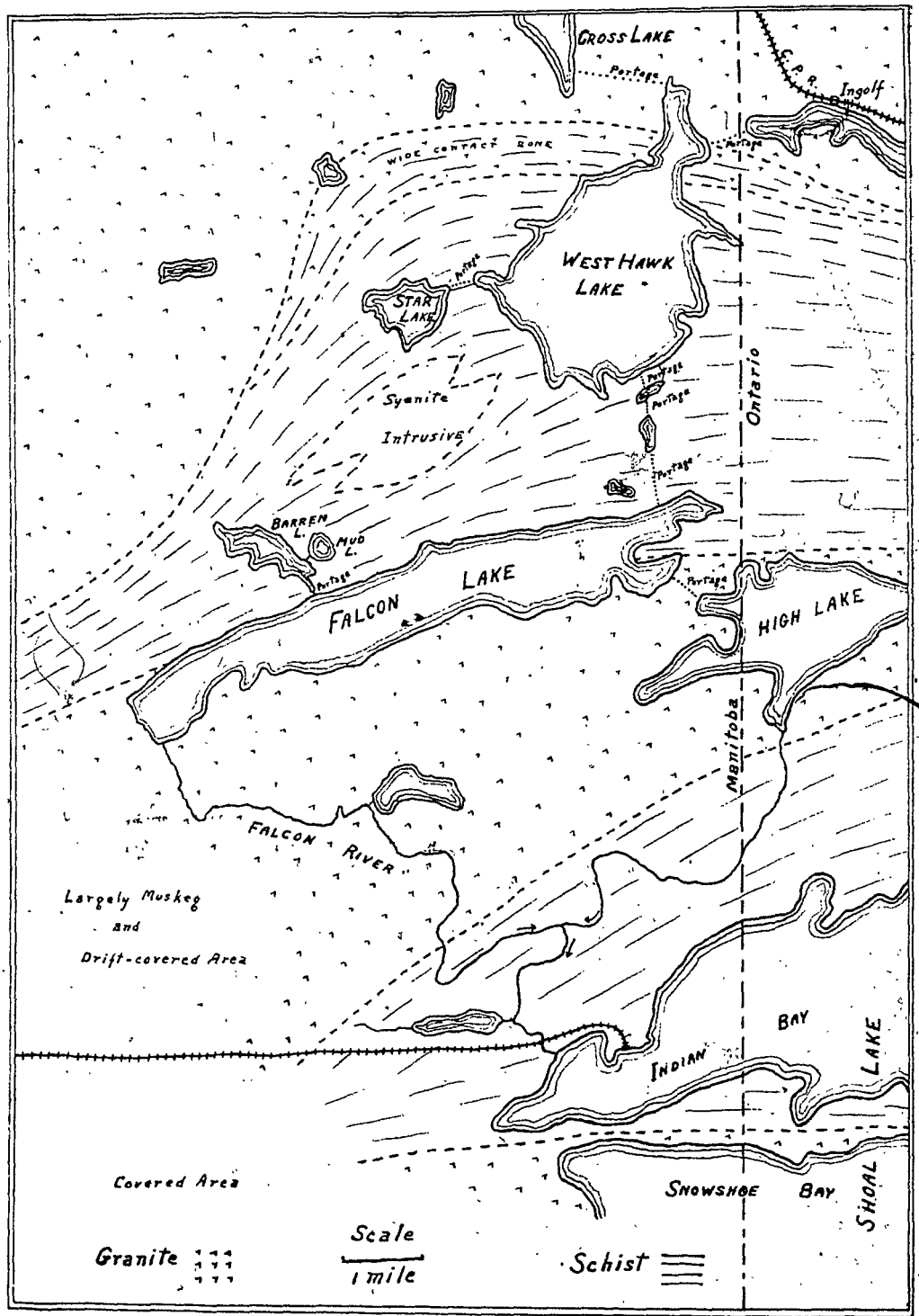
by extensions of lines from these points. Cheap electrical power could be secured from points on Winnipeg river.

Appendix to Chapter III

Discovery of Copper-Nickel Deposits Near Oiseau River

Certain specimens of copper and nickel-bearing sulphides are said to have come from a locality lying a few miles north of a point on Oiseau river, a short distance west of the lake of that name. The samples indicate that the deposits will prove to be of essentially the same nature as those found on Maskwa river, and no doubt, some outcrops of Maskwa River norite will be found in this locality. The occurrence is probably 10 or 15 miles distant to the southeast from the deposits on Maskwa river. Such a new discovery warrants the statement that a thorough prospecting of the Oiseau river country might yield valuable results; it is probable that other outcrops of norite occur in the district. Gold-bearing quartz has been recently reported to occur in the area between Oiseau and Winnipeg rivers, which indicates that the district may contain a variety of mineral deposits.

On Winnipeg River.



MAP OF BOUNDARY DISTRICT

CHAPTER IV.

THE BOUNDARY DISTRICT

Introduction and History

The name "Boundary District" is suggested as a suitable one for a portion of South-eastern Manitoba, which lies near the Ontario boundary, and portions of which have been referred to at different times as the West Hawk, Falcon and Star Lakes areas. The district may be regarded as an extension, to the west, of the Lake of the Woods country of Ontario, and it received some attention from gold prospectors during the "boom" period in the history of that country. Since that time there has been a little prospecting done in the district and fitful attempts at development work have been made.

Mineral deposits of a great many types have been found, but up to the present time none of these have attained commercial importance. During the early years, attention was paid particularly to auriferous quartz veins, of which there are many occurrences. Later on some work was done on large and continuous zones of schist, which are strongly filled and impregnated by several kinds of sulphides, and which have been proved to be stanniferous. There are many of these occurring in the vicinity of West Hawk and Star lakes. During the last few years many minerals have been found in a rather unique variety of deposits. Gold, bismuth, galena, sphalerite, chalcopyrite, pyrite, pyrrhotite, arsenopyrite, molybdenite, bismuthinite and other ore minerals occur with many interesting gangue minerals in a variety of associations. The latest interest in the economic possibilities of the district has centred about occurrences of molybdenite and scheelite.

Location and Means of Access

It has been pointed out that the Boundary district is an extension to the west of the Lake of the Woods area of Ontario. Lying close to and between the Canadian Pacific and the Greater Winnipeg Water District railways, it is perhaps the most accessible metalliferous area in the province. All parts of the district may be reached within a day from the railways. There are canoe routes, good portage trails and numerous footpaths and a few roads leading to the prominent mineral occurrences.

Surface Features

The aspect of the surface of the Boundary district is similar in every way to that of the Lake of the Woods area. The several lakes included in the area have beautiful shore-lines and islands; the natural beauties of the district and its relatively easy accessibility are tempting more and more people to use it as a summer resort. The area is nearly all covered by woods, which is largely of second growth, for the reason that the country has been visited at times by forest fires during the past 15 or 20 years. In some sections the original forest is still standing and some good timber is available. There is an abundance of game in the district; moose and deer are very common and the smaller animals are becoming quite numerous again.

Geology

The country near the Ontario boundary is similar geologically to that lying to the east in the vicinity of Lake of the Woods, which has been described by Lawson, Parsons and others. The area was actually included in Lawson's map, but was colored as being occupied by Laurentian granite. In his map of the country near the Ontario-Manitoba boundary, Parsons indicates the presence of an important belt of schists which he suggests is a continuation of a similar belt seen at Woodchuck bay of Lake of the Woods. An extension of this map, to include larger portions of Manitoba, is included in this bulletin.

Lawson groups the formations of the Lake of the Woods area in the following manner:

KEEWATIN:

Hydromica schists, etc.
Clay slate, etc.
Agglomerates.
Hornblende schists and altered traps, etc.

LAURENTIAN:

Later Granites.
Later Diorites.

Representatives of most of these types of rocks are found in adjacent parts of Manitoba. The belt of schists, as indicated on the accompanying sketch map, corresponds to the Keewatin, and in it are found many of Lawson's types. Granites occupy the areas on either side of the belt; they appear to be of two distinct types and to belong to two periods of formation. The older granite is typically gneissic in structure and corresponds to Lawson's Laurentian; the younger one, which is clearly intrusive into the other, corresponds to his later granite. The Laurentian is apparently confined to the northern parts of the district, and little reference is needed to it, since there is no evidence that it is connected in any way with the mineral deposits.

The later granite is found on both sides of the schists and is plainly intrusive into them. It appears to be part of a huge batholithic intrusion which is the prevailing rock over a great area in Manitoba, being found far to the west, north at least as far as Winnipeg river, and northwest in many parts of the country near Lake Winnipeg. In many places near the contact of this granite with the schists are found felsitic and porphyritic phases formed from the same magma. There are many varieties of this granite, depending on the size of the mineral grains and on the relative abundance of the different constituents, but typically it is a coarse-grained rock showing large idiomorphic feldspar crystals, which are embedded in a finer-grained matrix of quartz, feldspar and biotite mica. It generally shows a distinct reddish coloration.

A description of the schists which occupy a belt in this district will show clearly that they correspond to one of Lawson's Keewatin belts. The most prominent member is a hornblende schist which was largely derived from basic ellipsoidal lavas. Conglomerates occupy one important area which lies to the west of Star lake; the boulders and pebbles contained by them vary greatly in size and contain, besides abundant finely and coarsely grained basic igneous rock material, considerable quartz and quartzite. Banded sediments, garnetiferous sericite schists, many other varieties of schist, some of them derived from sediments, as suggested by the presence of graphite, others from different types of acid and basic felsitic igneous rocks, and also some fairly massive basalts, diabases and diorites, all occur in small and scattered areas or bands and make up the remainder of the outcrop of the belt.

Lying within the belt of schists and occupying a considerable area between Star and Falcon lakes, is a body of very coarsely grained syenite. It is intrusive into the surrounding Keewatin rocks and is older than or of about the same age as the later granite. It is of interest in that it may have had something to do with the mineralization of adjacent portions of the area.

The important geological event in connection with the formation of the mineral deposits of the district, was the intrusion of the later granite. It appears along both sides of the belt of schists and is plainly intrusive into them. This granite is similar to a granite described by Lawson as occurring near the Lake of the Woods gold veins; that they are identical is indicated by a comparison of the associated ores as found in the two localities.

Mineral Deposits

It has been pointed out that considerable prospecting has been done in the district and that many interesting types of mineral deposits have been found. Most of these appear to owe their origin to the intrusion of later granite and some of them are directly con-

nected with this rock. A description of the deposits as they appear in the different areas of the district will not be attempted; a better method will be followed, that of discussing the different types in the order of the directness of their association with the parent granite. Those that are most directly connected with this rock will be described first. Some details concerning individual occurrences will appear later.

Pegmatite Dikes.—These are usually found within a few hundred feet of the later granite. They outcrop as more or less continuous bands from 2 to 10 feet or more in width, and parallel usually to the layers of enclosing schist, which in most parts of the district are nearly vertical in position and are parallel to the contact with granite. They are, in most of their features, the typical pegmatities formed from granite magmas. The pegmatite is very coarsely grained in some parts, with individual crystals a foot or more in diameter; in other parts it is finer and contains considerable graphic granite. Besides the usual feldspar, quartz and mica, other minerals such as beryl and garnet occur in small amount. Molybdenite is the only prominent metallic mineral that has been found in the dikes. It occurs in crystals as a rule; these are usually large, an inch or more in diameter, though smaller ones are seen. Exceptionally the molybdenite occurs as a massive fine-grained variety. In places the coarser individuals are aggregated into large masses, some of which weigh in the neighborhood of 20 pounds. The molybdenite is a primary constituent of the pegmatites.

Aplite Dikes.—A few narrow dikes of aplite up to 2 or 3 feet in width were seen in the district. They are made up of quartz, feldspar and a little mica, which are in small equidimensional grains, and they carry molybdenite in grains which are distributed unevenly through the rock, some portions having a notable percentage and others having none.

Pegmatitic Quartz Veins.—On two claims, the IXL and the Hall, occur veins which consist mainly of quartz but also show pegmatitic materials, which are distributed usually in bands along the walls. They are best regarded as transition types between true pegmatites and quartz veins. They are of some interest in the nature of their metallic minerals. The most prominent of these is molybdenite. Bismuthinite occurs in close association with molybdenite in one of the veins and a little native bismuth is embedded in the quartz of the other. One specimen showed free gold in bismuthinite. One of these veins is about 50 feet from the contact with granite; the other is a half-mile. Both are irregular in width as far as the outcrop can be seen.

Molybdenite-bearing Quartz Veins.—In the vicinity of High lake and the east end of Falcon lake, near the contact of the schists and granite, are some wide bands of felsitic and porphyritic rocks which are derived from the granite magma. In these and in the schists, irregular masses, narrow veins and groups of stringers of quartz are found occupying fissured and sheared zones. The quartz is finely grained and in many places carries molybdenite in quantities varying between a trace and about 5 per cent. Small grains of pyrite and chalcopyrite are associated with the molybdenite, and samples taken from considerable widths give values of over $1.00 a ton in gold, silver and copper.

Scheelite-bearing Deposits.—These were probably formed during a late stage in the consolidation of the later granite. The scheelite and associated minerals are found along zones of movement which are indicated by the presence of fault-breccias, contorted schists and slickensided surfaces along well defined walls. Many high-temperature silicates such as feldspar, epidote, vesuvianite, amphibole and garnet, together with scheelite, quartz, calcite and small amounts of molybdenite, ilmenite and sphene were formed from the solutions given off by the cooling granite magma. These solutions filled available openings and reacted with the rock to develop other minerals. Some pyrrhotite and a few grains of chalcopyrite are present in the deposits.

Sulphide Zones in Schists.—In the vicinity of Star and West Hawk lakes there are many wide and continuous bands of schist which have been extensively impregnated by various kinds of sulphides. In parts of the zones are bands of solid sulphides several feet

in width. The zones strike with the schist and the dip is generally that of the enclosing formation. The prominent minerals are pyrrhotite and pyrite. Sphalerite is commonly seen in small quantities. Copper stains indicate the presence of copper sulphides. Galena is probably present. Nickel has been reported to occur in small amount in the pyrrhotite. Perhaps the most interesting feature of these deposits is that they contain in places as much as 1 per cent. of tin, which appears to be in combination with sulphides. Another point of interest is that scheelite has been found in a few places in intimate association with the sulphides of the zones.

Some examples of individual mineral occurrences will now be mentioned and described. The first of these will illustrate the groups of deposits which have already been discussed, and which owe their origin to the intrusion of later granite. There are several other deposits found in the district, whose origin is more doubtful; these will be described last of all.

The principal occurrences of molybdenite-bearing pegmatities are found on a group of claims which lie 2 or 3 miles to the north of the west end of Falcon lake. The *Gull* and *Tom Boy* claims have had the most work done on them and have perhaps the best showings of molybdenite. The following claims have had some work done on them and all show molybdenite: *Lucky Jack*, *Union Jack*, *Smuggler*, *Winnipeg*, *Lincoln*, *Garnet* and *Ajax*. The development work consists mainly of pits and trenches in the pegmatites. The high prices paid for molybdenite during the war made several of the dikes appear to have possibilities for economic production. The drop in price at the end of the war had a discouraging effect, and no work has been done on these claims since that time.

There are several occurrences of aplite carrying molybdenite in the vicinity of the pegmatites, but none appear to have the size and richness necessary for profitable production. The prominent occurrences of fine-grained molybdenite in quartz are on High lake in Ontario.

Many small outcrops of deposits carrying scheelite in notable quantities, and large outcrops carrying traces of the mineral, have been found throughout the belt of schists. One of the best outcrops was located on the *Empress* claim in 1918. This deposit lies a little to the northeast of the pegmatites which have just been described. The outcrop is oval in form, with stringers running out from the ends. An excavation was made and it was found that the width soon narrowed in depth, the outcrop apparently being near the bottom of what was probably a large lenticular mass. A shipment of cobbed material from this excavation on the Empress was sent to the Department of Mines, Ottawa, and W. B. Timm reported as follows: "Weight of shipment in pounds, 7,921; percentage of tungstic oxide, 1.65; weight of concentrates from 95.7 per cent. recovery, 177 pounds." As 2 per cent. is a rather low percentage of scheelite in hand-picked material, the results from the shipment are not encouraging. There has not been an exhaustive examination into the possibilities of the district for scheelite and further investigation and prospecting may yield some more interesting results.

Bruce has described several of the individual occurrences of the district; the following are extracts from his report:

"The gold-quartz veins from which platinum has been reported occur both in the granite and in the basic rocks intruded by the granite. Many of them are shear zones impregnated with quartz and sulphides. In such deposits the central part commonly consists of quartz of fine texture. Outwards the zone consists of silicified rock impregnated with sulphides which may also form veinlets of solid mineral. The assays given below show that the greater part of the gold content is associated with the sulphides rather than with the quartzose part of the zone. In the granite, fissures are more definite and there is less impregnation of the walls by vein material. The deposits occurring in the basic rocks seem to be arranged as a sort of aureole about the boss of granite. and this, together with the occurrence of visible gold and other metallic minerals in the differentiated parts of the intrusive, seems to be rather conclusive evidence that the vein material was derived from the granite."

Mass of Molybdenite-bearing Pegmatite.

Scheelite Ore bagged for shipment.

On the Molybdenite Claims

Ervin Camp.

Scenes in the Boundary District, 1918.

In 1917, Marshall collected samples from several of these deposits and assays of these indicated the presence of platinum in traces and in one sample, 0.10 ounces to the ton. Bruce's samples from the same and other deposits gave no trace of that metal. The results of gold assays, as given by Bruce, will be added to the following descriptions of individual occurrences, as taken from his report:

"On the *Magpie* claim a shaft 8 feet by 8 feet has been sunk to a depth of 8 feet in a rusty-weathering, silicified zone. The strike of the zone is northeast and the dip is vertical. A little white iron is visible in the altered rock." A sample taken from a width of 7 feet gave no gold on being assayed.

"Two shafts, 60 feet apart, have been sunk on a mineralized zone on the *Jewel* claim. The country rock is a dense, dark, hornblendic rock which is fairly massive. A zone one foot in width contains considerable sulphide." One sample from a width of 4 feet have no gold. Another from 5 feet gave 0.16 ounces.

"On the *Georgius* claim two shafts have been sunk, one along the hanging-wall, the other along the foot-wall of a sulphide impregnated zone which at the shafts is 30 feet in width. Pyrite or marcasite seems to be the most abundant mineral, but some quartz also occurs in the altered country rock." This property was also sampled by Bruce. Two samples taken across widths of 4 feet and one taken from the dump yielded no gold.

"*Enterprise.*—A shaft has been sunk to a depth of 20 feet at the point where the main vein divides. Open-cuts have also been made along the vein. The material on the dump contains a considerable amount of pyrite and in the open-cut small pockets of chalcopyrite were observed." Assays of two samples from this property are quoted: they gave 0.08 and 1.64 ounces of gold per ton.

"*Hall.*—The deposit examined on this claim is a lens of quartz 15 feet in length with a maximum width of 2 feet. It occurs in a dense, dark grey, dioritic rock which is somewhat schistose. The quartz lens cuts across the structure. Besides the quartz some molybdenite is present along with molybdite, its alteration product." An assay of a sample taken from the dump gave 0.13 ounces of gold to the ton. This is one of the pegmatitic quartz veins mentioned in the general discussion. A much larger outcrop, on which considerable surface work has been done, occurs on the same claim. It is not highly mineralized but carries gold and small quantities of bismuth.

"*Bowes.*—On this claim is a shaft 25 feet in depth, as well as a small open cut. The deposit in the shaft consists of two veins of quartz, each averaging about 4 inches in width, separated by 8 inches of altered rock. The vein dips very steeply and along its hanging-wall side arsenopyrite and other sulphides form a selvage at most an inch in width. This seems to be the part of the zone in which the highest values occur, but in choosing the sample only enough of this material was taken to form approximately an average of the mineralized zone." The sample mentioned gave on assay 2.42 ounces of gold to the ton.

The *IXL* claim has an interesting outcrop of a vein of the pegmatitic quartz type, situated on a small 'island' in the muskeg, quite close to a granite contact. The vein is not uniform in width. A pit is sunk on a fairly wide part of the outcrop; the material on the dump shows considerable amounts of bismuthinite and molybdenite.

"The country rock of the *Gold Coin* claim is a coarse-grained granodiorite or hornblende syenite with some biotite. In the pit there are two veins of quartz, 3 inches and 15 inches in width respectively. Along the foot-wall of the narrower vein which dips beneath the wider one, the rock is fractured slightly and is impregnated with arsenopyrite. The quartz in glassy and has dark zones which roughly parallel the walls. It contains arsenopyrite and smaller amounts of pyrite, the alteration of which has stained the quartz." A sample taken by Bruce from 18 inches of quartz gave on assay 0.08 ounces of gold to the ton. A sample taken by Marshall gave 2.30 ounces of gold and 0.10 ounces of platinum to the ton.

"The *Sunbeam* claim is also in the granitic boss. Several shallow pits have been sunk in a fine-grained, acidic mass of granite roughly oval in outline, 100 feet long by 75 feet wide. In places along the edge the normal syenite or granodiorite is distinctly banded parallel to the contact, but around the greater part of the border the acidic rock grades into the more basic normal facies. Apparently the acidic rock is a differentiate from the intrusive mass. Gash veins filled with quartz occur in the granite mass, but no metallic minerals were seen in them. Grains of pyrite and small bunches of galena and zinc blende occur scattered through the unfractured granite and seem without doubt to be a part of that rock." A sample taken by Bruce across 22 feet and another across 8 feet gave only a trace of gold. Marshall took a sample from a pit 8 feet deep; it gave 2.75 ounces of gold to the ton.

"The *Waverley* claim lies east of the Sunbeam in the granodiorite area. In this a pronounced shear zone strikes northeast and dips 50 degrees southeast. Along the footwall is a band of quartz 6 inches in width. A shaft has been sunk to some depth along the shear zone and a shallow open-cut has been carried along the vein for a distance of 200 feet. Judging from material on the dump, quartz formed only a small part of the material taken out." A sample taken by Bruce from across a foot of sheared rock gave 1.48 ounces of gold to the ton; another from 6 inches of quartz gave a trace of gold. Marshall's sample gave 0.80 ounces to the ton.

"More development work has been done on the *Penniac* group of claims than at any other point in the district. An inclined shaft has been sunk to a depth of 60 feet, the upper 35 feet of which has an angle of 60 degrees, and the lower 25 feet an angle of 40 degrees. From the bottom of the shaft drifts were carried northwest and southwest. The northeast drift is 70 feet long and the southwest drift is said to be of about the same length. Besides the shaft there are several large open cuts. A mill was installed to treat the ore, but the mechanical arrangements were not as convenient as they might have been and the process used was an experimental one. Possibly this may have been a factor in the failure of the mine.

"Mineralization occurs at the Penniac in the shear zones in the conglomerate and lavas. Pyrite is apparently the most common mineral. The shaft follows a quartz vein that is fairly constant, but is in places broken into stringers. A quartz vein 8 inches in width is exposed in the face of the northeast drift."

Wallace describes the deposit on the Penniac as being of a high-temperature type, and consisting of fine-grained quartz carrying pyrrhotite, arsenopyrite and free gold, together with small grains of feldspar and garnet. Bruce gives the following results of assays: From 8-inch channel sample of quartz from face of drift, 0.14 ounces of gold; ore from pocket, a trace; and tailings from mill, 0.08 ounces of gold to the ton. Marshall took a sample from the dump; it assayed 0.24 ounces of gold.

The *Sulphide Zones* are the largest and most continuous mineral bodies in the district. Some of them are traced across several claim-lengths. The most persistent bands appear to be those which outcrop on both sides of West Hawk Lake; other prominent deposits are found on and near Star lake and southeast of this locality towards Falcon lake. Wide bands of schist carry abundant sulphides, disseminated in grains, in stringers and in large lenses. Considerable development work has been done on many claims, in the form of stripping, trenching, open-cutting and shaft-sinking. Nickel has been sought for in the large masses of pyrrhotite, but apparently the content never runs over 1 per cent. Copper appears in places in the mineral chalcopyrite. To Mr. Neil Martin of Ingolf belongs the credit of demonstrating the fact that tin is carried in the sulphide zones. So far as known, this metal occurs in combination with sulphur, probably in some of the chalcopyrite-stannite group of isomorphous minerals. The sulphide bodies have not proved to be of commercial importance up to the present time. Sufficient work has not been done on them to positively determine their possibilities. The indications are that in most of them the low values of the metal contents and the unevenness in the distribution of these in the

deposits, will prevent their being worked. The metallurgical treatment of materials from these bodies would be complicated and costly. Some of the smaller zones have arsenopyrite as almost the sole sulphide; otherwise the deposits are of the general type which has been described and the different sulphides vary only slightly in their relative amounts in the different deposits.

Other types of deposits occur in the area. Among these are narrow veins of magnetite, associated with more or less chalcopyrite, quartz veins carrying notable amounts of chalcopyrite, and other kinds of lesser importance. The occurrence of cobalt bloom in a few places is perhaps worthy of mention, as well as reports of the occurrence of platinum in many deposits.

Economic Aspect of the District

Like most of the mineral-bearing areas of Southeastern Manitoba, the Boundary District has no mineral deposits that have attained the rank of notable producers of metals; but it is similar to them too, in having great potential possibilities. There are few areas anywhere of the same size, which can show so many occurrences of deposits with such a great variety of ore-minerals. The prospecting which the district has received has not been exhaustive by any means, and several of the known occurrences merit further investigation.

Open Cut and Head-frame of Shaft, Star Lake, Boundary District.

CHAPTER V.

BIBLIOGRAPHY

Bruce, E. L. ..... Molybdenite near Falcon Lake, Manitoba. Geol. Surv. Can., Summary Report, 1917, Part D.

Prospecting Areas in Manitoba, Manitoba Bulletins, Manitoba Northland, Nov. 1918.

Gold-Quartz Veins and Scheelite Deposits in Southeastern Manitoba Geol. Surv. Can., Summary Report, 1918, Part D.

Bramble, C. A. ..... The Rice Lake Gold Area. Manitoba Bulletins, Manitoba's Northland, Nov., 1918.

Colony, R. J. ..... A Norite of the Sudbury Type in Manitoba. Bull. Can. Inst. of M. and M. No. 103, Nov. 1920, and Can. Min. Journal, Vol. 41, No. 47, Nov. 26, 1920.

DeLury, J. S. ..... The Manigotagan Gold District, Manitoba, Can. Mining Jl., Vol. 37, Aug. 1, 1916.

Molybdenite at Falcon Lake, Manitoba. Can. Mining Jl., Vol. 38, No. 23, Dec., 1917.

Tungsten Ore Deposits near Falcon Lake, Manitoba. Can. Mining Jl., Vol. 37, No. 11, June, 1918.

Some Economic Aspects of the Falcon Lake District, Manitoba. Transactions, Can. Mining Inst., Vol. 22, 1919.

An Occurrence of Tin near the Ontario-Manitoba Boundary. Can. Mining Jl., Vol. 41, No. 25, June 25, 1920.

Dresser, J. A. ..... Gold-bearing District of Southeastern Manitoba. Geol. Surv. Can., Summary Report, 1916 (1 map).

Harding, W. K. ..... Field for the Prospector in Manitoba. Min. and Eng. World, May 27, 1916.

Lawson, A. C. ..... Lake of the Woods District. Geol. Surv. Can., Annual Report, 1917, Part CC.

Marshall, J. R. ..... Star Lake Area, Manitoba. Geol. Surv. Can., Summary Report, 1917, Part D.

Gold-bearing District of Southeastern Manitoba. G. S. C., Summary Report, 1917, Part D.

Moore, E. S. ..... Region East of South End of Lake Winnipeg. G. S. C. Summary Report, 1912, P. 262 (1 map).

Parsons, A. L. ..... Gold Fields of Lake of the Woods. Ontario Bureau of Mines, Annual Report, Vol. 20, Part 1, and Vol. 21, Part 1.

Tyrrell, J. B., and Dowling, D. B. ..... East Shore of Lake Winnipeg. G. S. C. Annual Report, 1898, Part G.

Wallace, R. C. Gypsum and Brines in Manitoba. G. S. C. Summary Report, 1914, page 73.

The Rice Lake District, The Star Lake District, etc. Report of Manitoba Public Utilities Commission, 1916.

Annual Mining Reviews, Bulletin of Can. Mining Inst. and Eng. and Min. Jl., Jan., 1917, 1918, 1919.

Area between Red River and Eastern Boundary of Manitoba, and between Winnipeg River and the National Transcontinental Railway, G. S. C. Summary Report, 1916.

APPENDIX

*SYNOPSIS OF REGULATIONS GOVERNING THE GRANTING OF MINERAL RIGHTS

Coal—Coal mining rights may be leased for a period of twenty-one (21) years renewable at an annual rental of One Dollar ($1) an acre. Not more than 2560 acres shall be leased to one applicant. A royalty at the rate of five cents (5c) per ton shall be collected on the merchantable coal mined.

A fee of Five Dollars ($5) shall accompany each application for a lease. This fee will be refunded if the rights applied for are not available, but not otherwise.

Petroleum and Natural Gas—The petroleum and natural gas rights which are the property of the Crown may be leased to applicants at a rental of twenty-five cents (25c) per acre, for the first year, and for each subsequent year a rental at the rate of fifty cents (50c) an acre, payable yearly in advance. The term of lease shall be twenty-one (21) years, renewable for a further term of twenty-one (21) years.

Application for a lease shall be made by the applicant in person to the Agent of Dominion Lands for the district in which the rights applied for are situated, or to a sub-agent for such district for transmission to the Agent. In case the location is in unsurveyed territory it shall be staked out by the applicant in person.

A fee of Five Dollars ($5) and the rental for the first year shall accompany each application for a lease. This fee and rental will be refunded if the rights applied for are not available, but not otherwise.

Placer Mining:—Any person over eighteen (18) years of age may enter for mining purposes, locate, prospect and mine for minerals upon any lands, the right to which entry, prospecting and mining is vested in or reserved to the Crown, except lands within the boundaries of a city, town or village, as defined by any provincial law or ordinance or specified by the Minister, or lands occupied by a building, or within the curtilage of a dwelling house, or lands lawfully occupied for placer mining purposes, or which form part of an Indian or other reservation.

An application for a grant of a claim shall be filed with the mining recorder within ten (10) days after the location thereof, if the claim is located within ten (10) miles of the mining recorder's office.

One (1) extra day shall be allowed for every additional ten (10) miles or fraction thereof.

Limestone, Granite, Slate, Marble, Gypsum, Marl, Gravel, Sand, Clay or any Building Stone—Dominion lands containing limestone, granite, slate, marble, gypsum, marl, gravel, sand, clay or any building stone may be leased by the Minister at an annual rental of One Dollar ($1) per acre, payable yearly in advance, for the purpose of quarrying out and removing therefrom stone or other material mentioned herein.

The term of the lease shall be twenty-one (21) years, renewable for a further period of twenty-one (21) years.

The maximum area of a quarrying location shall be forty (40) acres, and no person shall be allowed to locate more than one (1) location.

Application for a location comprising surveyed land shall be filed by the locator in person with the Agent of Dominion Lands for the district in which the location is situated. In unsurveyed territory no location is to be staked out.

A fee of Five Dollars ($5) shall accompany each application for a lease. This fee will be refunded if the rights applied for are not available, but not otherwise.

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* From Dr. Wallace's Bulletin "Mining and Mineral Prospects in Manitoba."

Quartz Mining—Any person having discovered mineral in place may locate a claim 1500 by 1500 feet by staking out the same with three (3) legal posts, one at each end of the location line, and a third at the spot where the mineral in place had been discovered. The two (2) location posts must have the name of the claim, a description of the ground, date of location and locator's full name written legibly upon them. The discovery post shall be marked "Discovery Post," and No. 1 post marked "Initial Post."

The claim shall be recorded within fifteen (15) days if located within ten (10) miles of a Mining Recorder's Office; one (1) additional day allowed for every additional ten (10) miles or fraction thereof. The fee for recording a claim is Five Dollars ($5).

At least One Hundred Dollars ($100) must be expended on the claim each year or paid to the Mining Recorder in lieu thereof. When Five Hundred Dollars ($500) has been expended or paid, the locator may, upon having a survey made, and upon complying with other requirements, lease the land, and permission may be granted to group any number of adjoining claims up to eight (8) in number for representation work, upon taking out a certificate of partnership before the commencement of the work.

If any person satisfies the recorder that he is about to undertake a *bona fide* prospecting trip and files a power of attorney from any member or person not exceeding two (2) authorizing him to stake claims for them in consideration of their having enabled him to undertake the trip, he may stake one (1) claim in the name of each such person upon any lode or vein which he may discover.

There are also regulations governing the issue of leases to dredge for minerals in the beds of rivers, and regulations governing the leasing of deposits of potash on Dominion lands.

Clay:—Clay locations are leased upon the condition that the plant suitable for the manufacture of brick or other clay products shall be erected within two (2) years from the date of the lease, and further that in each year of the term of the lease after the second year there shall be produced ready for shipment not less than One Hundred Thousand (100,000) bricks or their equivalent in some other form.

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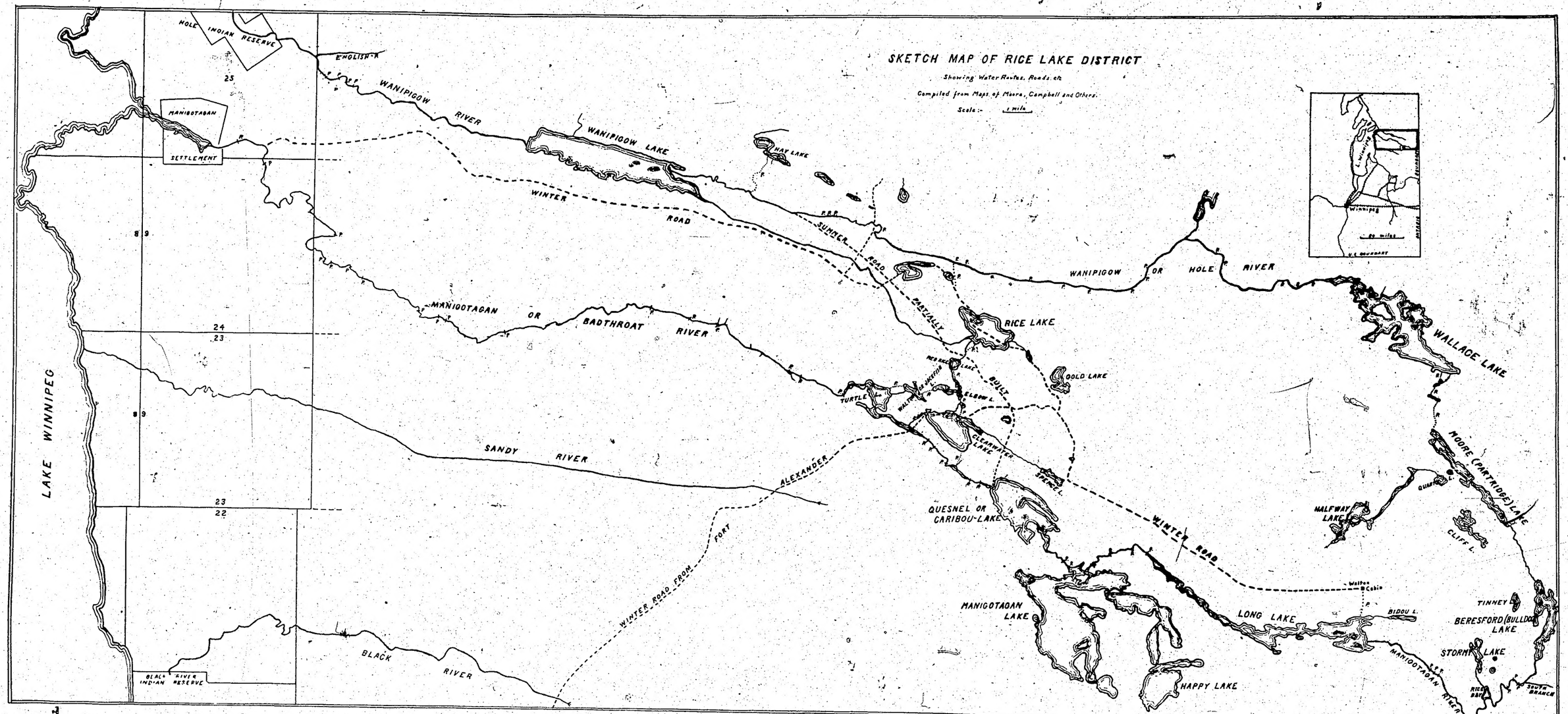

SKETCH MAP OF RICE LAKE DISTRICT